Vol. 15, No. 2
January 31, 1990

Energy Research Abstracts

Abstracts 2013–4550

Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

The Office of Scientific and Technical Information

The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

UNITED STATES DEPARTMENT OF ENERGY
Office of Scientific and Technical Information
Post Office Box 62
Oak Ridge, Tennessee 37831

International Copyright, © U.S. Department of Energy, 1990, under the provisions of the Universal Copyright Convention.
United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Vol. 15, No. 2
January 31, 1990
ISSN: 0160-3604
CODEN: ERABD

Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of nonreport literature is limited to that generated by Department of Energy activity.**

Scope

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for on-line searching as records within the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

Availability

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* (regular issues and annual indexes) from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401, FTS 626-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

- Canada
- Denmark
- Finland
- France
- Federal Republic of Germany
- Italy
- Japan
- The Netherlands
- Norway
- Spain
- Sweden
- Switzerland
- United Kingdom
- United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 75 countries and 14 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, the **Office of Scientific and Technical Information** both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a data base for on-line retrieval. The data base serves as well for the production of numerous OSTI publications.

How To Read A Citation

The coverage of literature in this publication includes several document types, ranging from technical reports to journal articles to books. The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
11. **Number of pages** or page range.
12. **Language** of document if non-English.
13. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
14. **Publisher's name and location** for documents published by a corporate or commercial source.
15. **Sponsoring organization.**
16. **Contract or grant number.**
17. **Secondary identifying number;** may be a conference number.
18. **Conference title, location, and date,** if applicable.
19. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
20. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

1849 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 **A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas.** Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 16(5): 581-589 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (380-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 **Polarization of fast particle beams by collisional pumping.** Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

GPO Superintendent of Documents
Government Printing Office
Washington, DC 20402

GPO Dep. Available for inspection or interlibrary loan at Government Printing Office regional depository libraries.

INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

TO OBTAIN NON-REPORT LITERATURE

Non-report literature generally is available from the commercial publisher or corporation listed in the citation. These documents may also be available for loan from local libraries. First, check with the local library. Other sources of information are:

Journal articles *Chemical Abstracts Service Source Index (CASSI)* tells which libraries, both U.S. and foreign, contain a journal and the available years. *Ulrich's International Periodicals Directory* contains information on the journal and its publisher. For librarians, another source of information is On-Line Computer Library Center (OCLC), for interlibrary loans.

Books, conferences, and monographs The source for these publications is the publisher or the originating society, organization, or institution. DOE-supported conferences and individual papers reporting DOE-supported research may be available as reports from OSTI.

Foreign material The Linda Hall Library is an excellent source of foreign materials. For translations of foreign language material, contact the Library of Congress National Translation Center. For material difficult to locate, check with the British Library Document Supply Centre.

On-Line Computer Library Center
6565 Frantz Road
Dublin, OH 43107-0702
614-764-6000

Linda Hall Library
5109 Cherry Street
Kansas City, MO 64110
816-363-4600

Library of Congress
National Translation Center
Washington, D.C. 20540
202-707-0100

British Library Document Supply Centre
Boston Spa, Weatherby
West Yorkshire
LS23 7BQ
United Kingdom

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
15:17641 DOE/ER/60664–1

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 15:18494 NTIS, PC A03/MF A01 - OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the data base records.* The following list includes all of the 40 first-level and the 289 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

Numerical Listing of Categories

01 COAL AND COAL PRODUCTS
- 03 Preparation
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Aspects
- 09 Artificial Stimulation
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves, Exploration, and Mining
- 04 Feed Processing
- 05 Uranium Enrichment
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing, Economics, and By-Products
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Safeguards, Inspection, and Accountability
- 60 Legislation and Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies
- 04 Economics

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste and Wood Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power-Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Systems
- 07 Solar Thermal Power Systems
- 08 Ocean Energy Systems
- 09 Solar Thermal Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology and Hydrology of Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope*.

05 Economic and Financial Aspects
06 Environmental Aspects and Waste Disposal
07 By-Products
08 Geothermal Power Plants
09 Geothermal Engineering
10 Direct Energy Utilization
20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
03 Regulations
04 Economics
05 Environmental Aspects
07 Tidal Power Plants
08 Wave Energy Converters

17 WIND ENERGY
01 Availability (Climatology)
03 Regulations
04 Economics
05 Environmental Aspects
06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
01 Power Plants and Power Generation
02 Environmental Control Technology
03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
02 Power Reactors, Nonbreeding, Light-Water Moderated, Non-boiling Water Cooled
03 Power Reactors, Nonbreeding, Graphite Moderated
04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
05 Power Reactors, Breeding
06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
07 Regulation and Licensing
08 Economics

22 NUCLEAR REACTOR TECHNOLOGY
01 Theory and Calculation
02 Components and Accessories
03 Fuel Elements
04 Control Systems
05 Environmental Aspects
06 Research, Test, and Experimental Reactors
07 Plutonium and Isotope Production Reactors
08 Propulsion Reactors
09 Reactor Safety

25 ENERGY STORAGE
01 Magnetic
02 Compressed Gas
03 Pumped Hydro
04 Capacitor Banks
05 Flywheels
06 Thermal
07 Liquefied Gas
08 Chemical
09 Batteries

29 ENERGY PLANNING AND POLICY
01 Energy Analysis and Modeling
02 Economics and Sociology
03 Environment, Health, and Safety
04 Natural Resources
05 Research, Development, Demonstration, and Commercialization
06 Nuclear Energy
07 Transport and Storage
08 Waste Heat Utilization
10 Conservation
20 Supply, Demand, and Forecasting
30 Policy, Legislation, and Regulation
40 Fossil Fuels
50 Hydrogen and Synthetic Fuels
60 Electric Power
80 Consumption and Utilization
90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION
01 MHD Generators
02 EHD Generators
03 Thermoelectric Generators
04 Thermionic Converters
05 Fuel Cells
08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
01 Buildings
02 Transportation
03 Industry and Agriculture
06 Municipalities and Community Systems
09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
01 Internal Combustion Engines
02 External Combustion Engines
03 Electric-Powered Systems
04 Hybrid Systems
05 Flywheel Propulsion
06 Vehicle Design Factors
07 Emission Control
08 Alternative Fuels

35 ARMS CONTROL
01 Policy, Negotiations, and Legislation
02 Proliferation
03 Verification

36 MATERIALS
01 Metals and Alloys
02 Ceramics, Cermets, and Refractories
06 Other Materials

40 CHEMISTRY
01 Analytical and Separations Chemistry
02 Inorganic, Organic, and Physical Chemistry
04 Electrochemistry
05 Photochemistry
06 Radiation Chemistry
07 Radiochemistry and Nuclear Chemistry
08 Combustion, Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING
02 Facilities and Equipment
03 Lasers
04 Heat Transfer and Fluid Flow
05 Materials Testing
08 Electronic Circuits and Devices
09 Waste Processing Plants and Equipment
10 Combustion Systems
20 Underground Engineering
30 Marine Engineering
40 Pollution Control Equipment
50 Power Cycles

43 PARTICLE ACCELERATORS
01 Design, Development, and Operation
02 Beam Dynamics, Field Calculations, and Ion Optics
03 Auxiliaries and Components
04 Storage Rings

44 INSTRUMENTATION
01 Radiation Instrumentation
02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
03 Miscellaneous Instruments
04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
01 Chemical
02 Nuclear
03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 05 Metabolism
- 06 Medicine
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health
- 30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 01 Radiation Effects
- 02 Thermal Effects
- 03 Chemicals Metabolism and Toxicology
- 04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 04 Geochemistry
- 05 Oceanography

64 PHYSICS I
- 01 Astrophysics and Cosmology
- 02 Atmospheric Physics
- 03 Atomic, Molecular, and Chemical Physics
- 04 Fluid Physics
- 50 High Energy Physics

65 PHYSICS II
- 10 Nuclear Physics
- 12-20 Nuclear Properties and Reactions
- 30 Nuclear Theory
- 40 Radiation and Shielding Physics
- 50 Medical Physics
- 60 Condensed Matter Physics
- 61 Superconductivity
- 70 Theoretical and Mathematical Physics

70 FUSION ENERGY
- 01 Plasma Research
- 02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
- 01 Management
- 02 Mathematics and Computers
- 03 Information Handling
- 04 Law
- 05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

Alphabetical Listing of Categories

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
35 ARMS CONTROL
56 BIOMEDICAL SCIENCES, APPLIED STUDIES
55 BIOMEDICAL SCIENCES, BASIC STUDIES
40 CHEMISTRY
01 COAL AND COAL PRODUCTS
30 DIRECT ENERGY CONVERSION
20 ELECTRIC POWER ENGINEERING
32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
29 ENERGY PLANNING AND POLICY
25 ENERGY STORAGE
42 ENGINEERING
52 ENVIRONMENTAL SCIENCES, AQUATIC
50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
45 EXPLOSIONS AND EXPLOSIVES
70 FUSION ENERGY
99 GENERAL AND MISCELLANEOUS
58 GEOSCIENCES
15 GEOTHERMAL ENERGY
57 HEALTH AND SAFETY
13 HYDRO ENERGY
08 HYDROGEN
44 INSTRUMENTATION
07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
36 MATERIALS
03 NATURAL GAS
05 NUCLEAR FUELS
21 NUCLEAR POWER PLANTS
22 NUCLEAR REACTOR TECHNOLOGY
04 OIL SHALES AND TAR SANDS
09 OTHER SYNTHETIC AND NATURAL FUELS
43 PARTICLE ACCELERATORS
02 PETROLEUM
64 PHYSICS I
65 PHYSICS II
14 SOLAR ENERGY
16 TIDAL AND WAVE POWER
17 WIND ENERGY

Energy Research Abstracts

01 COAL AND COAL PRODUCTS

Refer also to citation(s) 2612

0103 Preparation

Refer also to citation(s) 2048, 2056, 2058, 2079

2013 (CONF-8911107–1) **The development of clean coal technology in the United States.** Streets, D.G. Argonne National Lab., IL (USA). 1989. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Workshop on clean technology; Bangkok (Thailand); 6-8 Nov 1989. Order Number DE90001926. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The United States has made a $5-billion commitment, to be shared by the government and the private sector, to the development of a new generation of clean-coal technologies. Because the nation has a resource imperative to develop domestic coal supplies and a strong commitment to environmental protection, it seems that clean coal technologies are the preferred solution for power generation needs in the United States in the medium-term. The lessons learned during this demonstration program could have important implications for technology development and deployment in other countries. The purpose of this paper is to discuss some of the aspects of the US Clean Coal Technology (CCT) demonstration program that could be relevant to other countries. 2 refs., 8 tabs.

2014 (DOE/PC/88561–T1) **Column flotation of coal with fluorosurfactants: Final report.** Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center. Oct 1989. 58p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AI22-88PC88561. Order Number DE90002300. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Laboratory tests were carried out by the US Bureau of Mines, Salt Lake City Research Center to evaluate the potential of column flotation technology, coupled with novel fluorosurfactant collectors, for the selective flotation of fine coal from pyritic sulfur and mineral matter. The results on flotation feeds of both −100 and −400 mesh Middle Kittaning seam coal samples are presented. 4 refs., 23 figs., 9 tabs.

2015 (DOE/PC/88877–T3) **Coal surface control for advanced physical fine coal cleaning technologies: Quarterly report, May 1–July 31, 1989.** Morsi, B.I.; Chiang, S.H.; Sharkey, A.; Blachere, J.; Klinzing, G.; Streeter, R.; Gray, R.; Venkatadri, R.; Chen, Y.S.; Chiarelli, P.; Perez, L.; Kim, S.; Ciocco, M.; Bi, H. Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering. 1989. 165p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88877. Order Number DE90001945. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The overall objective of the project is to develop techniques for coal surface control prior to the advanced physical fine coal cleaning process of selective agglomeration to achieve 90% pyritic sulfur rejection while operating at a Btu recovery greater than 90% based on run-of-mine coal. The project consists of the following tasks: Project Planning; Method for Analysis of Samples; Development of Standard Beneficiation Test; Grinding Studies; Modification of Particle Surface; and Exploratory R&D and Support. This quarter, efforts were focused on the assessment of grinding studies. The three base coals, Upper Freeport, Indian county, PA; Pittsburgh No. 8, Belmont county, OH; and Illinois No. 6, Randolph county, IL, were ground under three grinding environments, air, argon, and oxygen saturated water. A large number of experimental runs were conducted to determine the effects of particle size, grinding method as well as operating conditions on Btu recovery and ash/total sulfur rejections of the three base coal. The samples obtained were analyzed using the techniques established and tested. In addition, the effects of chemical reagents on surface properties of coal particles were studied. 13 refs., 68 figs., 47 tabs.

2016 (DOE/PC/88881–T4) **[Advanced physical fine coal cleaning: Froth flotation]: Quarterly technical progress report, July 1, 1989–September 30, 1989.** Kaiser Engineers, Inc., Pittsburgh, PA (USA). [1989]. 51p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88881. Order Number DE90003374. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

An engineering development project was prepared to build upon the basic research effort conducted under a solicitation for research into Fine Coal Surface Control. The engineering development project is intended to use general plant design knowledge and conceptualize a plant to utilize advanced froth flotation technology to process coal and produce a product having maximum practical pyritic sulfur reduction consistent with maximum practical BTU recovery. 26 figs., 15 tabs.

2017 (DOE/PC/88886–T4) **Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the fourth quarterly, July 1, 1989–September 30, 1989.** Boysen, J.E.; Kang, T.W.; Cha, C.Y.; Berggren, M.H.; Jha, M.C. Western Research Inst., Laramie, WY (USA). Oct 1989. 69p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88886. Order Number DE90003036. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The main objective of this research is to develop a thermal process for drying fine coal that (1) reduces explosion potential, (2) uses a fluidized bed with minimum elutriation, (3) produces a stable dry coal by preventing moisture reabsorption and autogeneous heating, (4) reduces fugitive dust emissions, and (5) is technically and economically feasible. The project scope of work requires completion of five tasks: (1) project planning, (2) characterization of the two feed coals, (3) bench-scale IFB drying studies, (4) product characterization and testing, and (5) technical and economic process evaluation. The project technical achievements are primarily related to understanding of the behavior of the two coals in the IFB reactor. Solids residence time and solids entrainment can be correlated using the Reynolds number. Gas produced from the coal during drying and the product composition can be correlated to the average dryer temperature. A dry product with minimal proximate moisture and substantially increased heating value can be produced from either of these coals under a wide variety of fluidizing gas-to-solids ratios and IFB operating temperatures. Product characterization indicates that moisture reabsorption can be significantly reduced and that fugitive dust contents can be almost completely reduced. 4 refs., 19 figs., 24 tabs.

0104 Processing

Refer also to citation(s) 2058, 2062, 2064, 2065, 2136, 2143, 2729, 2828

2018 (CONF-891079–1) **Chlorine related degradation of materials in coal liquefaction.** Keiser, J.R.; Judkins, R.R. Oak Ridge National Lab., TN (USA). 1989. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. (CONF-8910280–1: 1. international conference on chlorine in coal; Joint meeting of the U.S. DOE (PETC)/Japan AIST-NEDO Committee on Coal Liquefaction, Chicago, IL (USA); Tokyo (Japan), 9-11 Oct 1989; 27 oct - 10 nov 1). Order Number DE90002707. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the 1970's, a concentrated effort was directed toward development of coal liquefaction in the United States, at least in part, because of the demonstrated vulnerability of this country during the oil embargoes. A number of pilot plants were operated to evaluate different liquefaction processes, and the performance of structural materials was assessed in these plants. Although material performance in coal liquefaction plants had many similarities with performance in petrochemical plants, the presence of significant amounts of chlorine in some coals caused serious problems. Severe

localized corrosion that was related to amine hydrochlorides was encountered in fractionation columns, and chloride stress corrosion cracking was found in many pipes and vessels. 12 refs., 5 figs.

2019 (DOE/PC/79926–6) **Kinetics of coal conversion to soluble products: January 1, 1989–June 30, 1989.** Yamada, O.; Larsen, J.W. Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry. 2 Aug 1989. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79926. Order Number DE90002764. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objectives of this work are: (1) to measure the kinetics of the conversion of coals to soluble products under model liquefaction conditions using gel permeation chromatography (GPC) techniques to count the number of bonds broken; and (2) to analyze these data using kinetic schemes based on the behavior of crosslinked macromolecular networks. 5 refs., 1 tab.

2020 (DOE/PC/79926–7) **Kinetics of coal conversion to soluble products: Quarterly report, July 1, 1989–September 30, 1989.** Yamada, O.; Larsen, J.W. Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry. 13 Oct 1989. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79926. Order Number DE90002765. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objectives of this work are: (1) to measure the kinetics of the conversion of coals to soluble products under model liquefaction conditions using gel permeation chromatography (GPC) techniques to count the number of bonds broken; and (2) to analyze these data using kinetic schemes based on the behavior of crosslinked macromolecular networks. 10 refs., 3 figs.

2021 (DOE/PC/79933–8) **Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 8, June 15, 1989–September 15, 1989.** Massoth, F.E.; Seader, J.D. Utah Univ., Salt Lake City, UT (USA). 20 Sep 1989. 28p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79933. Order Number DE90001694. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The research entails a study of hydrodenitrogenation of model compounds and coal-derived liquids using three NiMo/alumina catalysts of different pore size to develop, for restrictive diffusion, a relationship that can be used for estimating reliable effectiveness factors. Measurement of pertinent properties of the catalysts and of several coal liquids. Determination of effective diffusivities and tortuosities of the catalysts. Development of restrictive diffusion correlations from data on model N-compound reactions. Testing of correlations with coal-liquid cuts and whole coal-liquid feed. 5 refs., 8 figs., 10 tabs.

2022 (DOE/PC/88812–T5) **Process and analytical studies of enhanced low severity co-processing using selective coal pretreatment: Quarterly technical progress report, June–August, 1989.** Baldwin, R.M.; Miller, R.L. Colorado School of Mines, Golden, CO (USA). Dept. of Chemical Engineering and Petroleum Refining. 1989. 18p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88812. Order Number DE90003373. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes progress on research during the fourth quarter of this contract dealing with applications of coal pretreatment techniques in coal hydroliquefaction by co-processing. The objectives of the project are to investigate various coal pretreatment techniques and to determine the effect of these pretreatment procedures on the reactivity of the coal. Reactivity enhancement will be evaluated under both direct hydroliquefaction and co-processing conditions. Research this quarter focused on the experimental evaluation of a matrix of runs for coals that had been alkylated following the procedure described by Sternberg et al. Both a Wyodak subbituminous and an Illinois No. 6 bituminous coal from the Argonne Premium Sample Bank were alkylated via the Sternberg recipe. Four different sets of reaction conditions were employed. A series of runs to investigate the effect of drying and water on reactivity was carried out. 4 refs., 3 figs., 1 tab.

2023 (DOE/PC/88813–T4) **A solid-state NMR study of condensation/retrograde reactions during coal liquefaction: Quarterly progress report, July 1–September 30, 1989.** Miknis, F.P. Western Research Inst., Laramie, WY (USA). Nov 1989. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88813. Order Number DE90003372. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this work is to perform an NMR study of the aromaticity in coal, coal derived products and/or model compounds generated by pyrolysis and thermal solubilization of coal in the presence of a hydrogen donor solvent. Cross Polarization with Magic-Angle Spinning (CP/MAS) will be used to measure the carbon aromaticity, and Combined Rotation and Multiple Pulse Spectroscopy (CRAMPS) NMR techniques will be used to measure the hydrogen aromaticity. From these NMR measurements the aromatic hydrogen-to-carbon ratio will be obtained and used to study condensation/retrograde reactions during coal liquefaction. 2 refs., 1 fig.

2024 (DOE/PC/88917–T2) **A new approach in ultrapurification of coal by selective flocculation: Annual report.** Moudgil, B.M. Florida Univ., Gainesville, FL (USA). Sep 1989. 100p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88917. Order Number DE90003371. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The objective of the present study is to utilize, and if necessary further develop, mathematical model to predict the conditions for optimum selectivity in coal-coal pyrite/coal refuse system with a given flocculant. Coal and coal refuse from Pittsburgh-Bruceton mine and coal pyrite from a southwestern Pennsylvania coal preparation plant were used in this study. Several polymers, including polyacrylamides, polyethylene oxide and hydrophobic polymers were examined for their selectivity towards flocculating coal, coal refuse or coal pyrite. The computational model for the coal-coal pyrite/coal refuse system was developed and rewriting the computer program in FORTRAN (it was originally written in PASCAL) was completed. This with the aid of advance programming techniques, enabled computation with more particles than was possible before. 31 refs., 30 figs., 11 tabs.

2025 (DOE/PC/88935–T3) **Inhibition of retrogressive reactions in coal/petroleum co-processing: Quarterly technical progress report, June 1, 1989–August 31, 1989.** Schobert, H.H.; Tomic, J. Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences. Jul 1989. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88935. Order Number DE90002761. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of this project is to develop a fundamental understanding of the reactions occurring at the onset of coke formation during the co-processing of coals with petroleum residue. The specific objectives include examination of chemical components, or groups of components, in coals and petroleum feedstocks to quantify and rank the effects of these components on retardation or enhancement of coke formation. The work involves bench scale reactions in microautoclaves, supplemented by optical microscopy of carbonaceous residues and such instrumental analyses as ^{13}C NMR and GC/MS. During this reporting period the work focused largely on the identification of solvation and dispersion effects. Microautoclave testing has been started with mixtures of model compounds and the selected coals, to begin to identify those features of model compound structure which are important in solvating the coals. 4 refs., 3 figs., 2 tabs.

2026 (DOE/PC/90910–T1) **Enhanced coal liquefaction by low-severity catalytic reactions: Final report.** Davis, A.; Derbyshire, F.J.; Mitchell, G.D.; Schobert, H.H. Pennsylvania State Univ., University Park, PA (USA). Energy and Fuels Research Center. Jul 1989. 175p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90910. Order Number DE90001460. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This program of research has involved the investigation of the liquefaction of coals by reaction in successive stages of increasing temperature in order to understand the chemical processes occurring in the individual stages. Process variables included the influence of coal rank (lignite, subbituminous, hvCb and hvAb) and the role of catalysts (1.0 wt% Mo or Fe or 1.0% Fe + 0.1% Mo) and vehicle solvents. The exact nature of the relatively subtle reactions occurring in the low- and high-temperature stages have not been clearly identified in this research. Our results suggest that the first

stage reactions involve mild hydrogenation. An increase in the pool of hydrogen available within the coal structure could precondition the coal and favorably bias the course of the higher temperature reaction toward hydroliquefaction rather than pyrolysis. We have determined that the temperature-stages reaction sequence can accommodate fairly large changes in reaction conditions before an appreciable effect on product yield becomes apparent. 57 refs., 43 figs., 40 tabs.

2027 (EMR-SFA–83) **Synthetic fuels from coal-heavy oil mixtures. Phase 1. A survey of the work applicable to coal bitumen mixtures as synthetic fuels feedstock.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). Jan 1983. 8p. Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth Street, Ottawa, Ontario, Canada K1A OG1.

This paper presents a review of significant research and development being performed worldwide that is applicable to the conversion of coal and bitumen to synthetic liquid fuels. Coal liquefaction processes are outlined as historical background. The process that is being sought by this review is one that combines the processing of coal and bitumen to produce a synthetic crude oil, notably one in which bitumen serves as the slurry medium for coal. Research in Canada, the USA, Europe, and Japan is summarized. Major current efforts are the Alberta Research Council program using bitumen and heavy oil, and the Auburn University/Cities Service program using oil refinery streams as feedstocks with coal. 17 refs., 2 tabs.

2028 (ETDE-mf–0717924) **Key chemicals from synthesis gas - development of novel zeolites as catalysts for conversion of methanol into hydrocarbons.** Fleckenstein, T.; Marquart, R.; Kahl, J.; Belendorff, K.; Groeb, J.; Herrmann, C.; Danner, A. Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Chemische Technologie. [1989]. 110p. (In German). 03 C113. Order Number DE90717924. Available from NTIS (US Sales Only), PC A05/MF A01.

The present study comprises the production and characterization of zeolites as well as their use as catalysts for the conversion of methanol into olefins. The reaction was carried out in small fixed-bed reactors. By using IR spectroscopy for the characterization of the acid OH groups as active centres of the zeolites, the reaction could be observed on the catalyst surface. (EF).

2029 (ETDE-mf–0721837) **Production of coke with specific metallurgical properties. Analysis of conditions in the blast furnace.** Velikonja, L. Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen. 21 Aug 1987. 105p. (In German). Order Number DE90721837. Available from NTIS (US Sales Only), PC A06/MF A01.

In the present study tests are carried out on cokes with the aim to reduce the alkalis and sulphur contents during the coking process by addition of suitable auxiliary substances. The following points are of interest: 1. discussion of the behaviour of sulphur and alkalis in blast furnaces, 2. summary of available knowledge on the behaviour of coke in blast furnaces, 3. discussion of the possibilities to influence sulphur and alkalis during the coking process by using thermodynamic calculations, 4. alkali volatilization tests on model substances under conditions similar to coking processes, 5. investigation of the influence of different additives on sulphur and alkalis on the basis of coking tests and 6. discussion of the whole field of problems. (orig./RB).

2030 (NEI-FI–14) **Gasification of solid fuels in energy management of industry.** Kauppa- ja Teollisuusministerio, Helsinki (Finland). Energiaosasto. 1984. 196p. (In Finnish). Order Number DE90719345. Available from NTIS (US Sales Only), PC A09/MF A01.

In this project, which was finacially supported by the Ministry of Trade and Industry the technical and economical problems and possibilities associated with the gasification of peat and park have been studied. Main attention has been paid on experimental research of different gascleaning methods and on the feasibility studies of three gasturbine power plant consepts, which were based on the present state of technology. The feasibility of a 2 MWe gas turbine power plant, which was based on pressurized gasification and combustion, was also considered. The following gas cleaning methods were studied: the utilization of an inlet volume of a gas turbine as a particle separator (so called super cyclone), the efficiency of a wet cyclone as a gas cleaner, the conventional wet cleaning and a dry cleaning method. Both the super cyclone trials and the dry cleaning trials gave very promising results. With the stated initial conditions and calculation methods the gas turbine alternative with atmospheric gasification, with wet gas cleaning system and with wet oxidation of waste waters became most expensive in every case. However, the differences in comparison with the back pressure powerplants were within 5-10%. The feasibility of a gas turbine power plant can be improved especially by developing the dry cleaning methods of the LCV-gas. The limiting investment cost for a 2 MWe gasturbine power plant was estimated to be 21 Mmk. It seems possible to remain below this limit, if pressurized gasification and combustion is used. On the gas cleaning of this alternative there are, however some technical problems which should be still studied and solved.

2031 (PB–89-226930/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1986. Report for 1 January-31 March 1986.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 29 May 1986. 33p. Available from NTIS, PC A03/MF A01.

See also PB–89-191241.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. This report describes activities associated with continuation of construction at the commercial facility, permits applied for or received, and progress in laboratory construction methods development.

2032 (PB–89-226948/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1986. Report for 1 April-30 June 1986.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 28 Aug 1986. 38p. Available from NTIS, PC A03/MF A01.

See also PB–89-226930. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic fuels plants. This report describes activities related to construction of commercial facilities, completion of design engineering, continued laboratory construction and equipping solid-waste and water permits, and landfill construction.

2033 (PB–89-226955/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1986. Report for 1 July-30 September 1986.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 25 Nov 1986. 35p. Available from NTIS, PC A03/MF A01.

See also PB–89-226948.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an

Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic fuels plants. This report summarizes activities completed for construction monitoring, review of solid-waste landfill operations, laboratory equipment installation, and development of health and safety reviews.

2034 (PB–89-226963/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1986. Report for 1 October-31 December 1986.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 26 Feb 1987. 125p. Available from NTIS, PC A06/MF A01.

See also PB–89-226955.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic fuels plants. Activities associated with construction monitoring, final laboratory construction, permitting, and operation of solid- and hazardous-waste landfills, and health and safety review are described. The Acceptance Test Report for air quality and meteorological monitoring and the water permit are appended to the report.

2035 (PB–89-226971/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1987. Report for 1 January-31 March 1987.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 27 May 1987. 192p. Available from NTIS, PC A09/MF A01.

See also PB–89-226963. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. This report describes activities during construction, equipment commissioning and ambient air monitoring for baseline data. Construction-stage health and safety review is also described. Air quality and meteorological data are included.

2036 (PB–89-226989/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1987. Report for 1 April-30 June 1987.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 28 Aug 1987. 162p. Available from NTIS, PC A08/MF A01.

See also PB–89-226971. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. Highlights of construction, equipment commissioning, laboratory training, and definition of sampling points and methods are given.

2037 (PB–89-226997/XAB) **Environmental Monitoring plan for the Dow Syngas Project. Quarterly report: Third quarter, 1987. Report for 1 July-30 September 1987.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 25 Nov 1987. 255p. Available from NTIS, PC A12/MF A01.

See also PB–89-226989. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. The report describes the plant process, status of Commissioning Phase activities for the quarter, compliance sampling for air, water, and solid-waste permits. Data for characterization of process and effluent streams are summarized, and the ambient air monitoring data are given.

2038 (PB–89-227003/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1987. Report for 1 October-31 December 1987.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 26 Feb 1988. 256p. Available from NTIS, PC A12/MF A01.

See also PB–89-226997. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic fuels plants. This report describes monitoring activities under the Commissioning Phase of operations, when 974 samples and 1993 tests were completed. Trial sampling in most areas was performed successfully, although stack performance and compliance testing could not be performed due to uneven operations. Air monitoring under PSD requirements for the quarter is included as Appendix I.

2039 (PB–89-227011/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1987. Report for 1 January-31 December 1987.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 28 Jun 1988. 393p. Available from NTIS, PC A17/MF A01.

See also PB–89-227003. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste

for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. This Annual Health and Safety Report includes summaries of activities pursuant to the industrial-hygiene survey and the Project safety program during startup and initial operation of the plant. Area and personnel monitoring for potentially harmful agents are described, and detailed sampling data are appended to the report.

2040 (PB–89-227029/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1988. Report for 1 April-30 June 1988.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 30 Aug 1989. 139p. Available from NTIS, PC A07/MF A01.

See also PB–89-227011. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. This report describes Commissioning Phase activities completed, including 1594 samples taken and 4422 tests performed for air and water pollutants. Data from the test results will be available at the end of the Commissioning Phase. The Test Plan for compliance monitoring of the incinerator and turbine is appended to the report, as is the Gaseous Monitoring Test Plan.

2041 (PB–89-227037/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1988. Report for 1 July-30 September 1988.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 29 Nov 1988. 158p. Available from NTIS, PC A08/MF A01.

See also PB–89-227029. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. Monitoring described includes 1486 samples, submission of a permit to burn syngas, ground-water monitoring of the solid waste landfill, and performance testing of the incinerator and gas turbine stacks.

2042 (PB–89-227045/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1988. Report for 1 October-31 December 1988.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 24 Feb 1989. 29p. Available from NTIS, PC A03/MF A01.

See also PB–89-227037.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. Activities associated with obtaining over 1700 samples, fugitive emissions testing, and medical monitoring are described. Operations during 1709 hours of coal use are discussed, as are modifications to the waste-water-treatment system during a major outage.

2043 (PB–89-227052/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Annual report. Report for 1 April 1988-31 March 1989.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 30 Jun 1989. 122p. Available from NTIS, PC A06/MF A01.

See also PB–89-227045. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. Monitoring is described for completion of Commissioning Phase and initial Comprehensive Phase operations. The Project established daily, monthly, quarterly, and annual production records during this period. The Appendices include ground-water monitoring data, air-permit notifications, and other compliance documents.

2044 (PB–89-227078/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1989. Report for 1 April-30 June 1989.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 3 Aug 1989. 102p. Available from NTIS, PC A06/MF A01.

See also PB–89-227060.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. Activities related to obtaining 1311 samples and performing 3957 tests are highlighted in the document. Dispersion modeling of 10-Second Syngas Emergency Release is described, and the ground-water monitoring annual report is included.

2045 (PB–89-227086/XAB) **Cool Water Coal Gasification Program: Environmental Monitoring Plan. Volume 1-5, Section 1-12, Appendices A-F. Report for 1984-89.** Cool Water Coal Gasification Program, Daggett, CA (USA). 7 Jul 1989. 1702p. Available from NTIS, PC A99/MF E12.

Also pub. as Radian Corp., Sacramento, CA. rept. no. DCN-89-218-049-106. See also PB–89-160899.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. The Program agreed to comply with existing environmental-monitoring regulations and to develop an Environmental Monitoring Plan incorporating supplemental monitoring in the areas of water, air, solid waste, worker health and safety, and socioeconomic impacts during the period 1984-1989. As the first commercial-scale integrated gasification combined-cycle plant for generating energy from coal, the plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid

wastes, and produce very few air emissions. This report concludes the analysis of potential environmental impacts due to operation of this particular technology. Indicator parameters and correlations are discussed along with summaries of results while operating the main and quench gasifiers, and burning four types of coal. The extensive data demonstrate environmental acceptability of integrated coal gasification using both high-sulfur Eastern coals and low-sulfur Western coals; 97% sulfur removal was achieved.

2046 (PB–89-227094/XAB) **Cool Water Coal Gasification Program: Environmental monitoring plan. Final Report, non-proprietary. Executive summary. Report for 1984-1989.** Cool Water Coal Gasification Program, Daggett, CA (USA). 7 Jul 1989. 59p. Available from NTIS, PC A04/MF A01.

Also pub. as Radian Corp., Sacramento, CA. rept. no. DCN-89-218-049-107. See also PB–89-227086.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Cool Water Coal Gasification Program is one of the four projects awarded financial assistance. The Program agreed to comply with existing environmental-monitoring regulations and to develop an Environmental Monitoring Plan incorporating supplemental monitoring in the areas of water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1984-89. As the first commercial-scale integrated gasification combined-cycle plant for generating energy from coal, the plant is designed to process a variety of coals with no liquid discharge, produce non-hazardous solid wastes, and produce very few air emissions. This Executive Summary highlights five years of operations, using main and quench gasifiers and four types of coals. Summary tables demonstrate that environmental performance met all permit requirements, and performance of major pollution-control systems met or exceeded design pollutant-removal efficiencies. Fugitive emissions, waste water, solid waste, ambient air, and indicator parameter monitoring are also discussed. No areas of major environmental concern were identified.

2047 (PB–89-232631/XAB) **Advanced gasifier-desulfurizer process development for SNG (substitute natural gas) application. Final report, August 1987-December 1988.** Blinn, M.B.; Cover, A.E.; Haldipur, G.B.; Datta, S.C.; Holmgren, J.D. KRW Energy Systems, Inc., Pittsburgh, PA (USA). Jun 1989. 210p. (KRW–89-001). Available from NTIS, PC A10/MF A01.

KRW conducted investigations of calcium-promoted coal pyrolysis and gasification by means of bench-scale studies and an oxygen-blown PDU test. Results were used in a design study of a commercial KRW gasifier-desulfurizer, operating on Pittsburgh No. 8 coal and limestone for production of SNG. Bench-scale fluid-bed reactor studies were conducted with various fluidizing gases at temperatures and pressures of 1650 to 1950 F and 40 to 450 psig, with and without limestone, to give methane-yield and tar-yield data. The gasification kinetics studies of chars produced gave data which showed that limestone increases char reactivity and exerts a catalytic effect. Methane yields correlated exponentially to pressure. The bench-scale test results lead to an expectation that feeding some of the coal to the upper portion of the gasifier will increase methane yield and decrease oxygen consumption. In two PDU test-set points, expected operability and performance of the oxygen-blown gasifier-desulfurizer were confirmed. In Set Point 2, in-bed desulfurization efficiency was 88% and the product-gas higher heating value was 302 Btu/scf. The test results provided inputs to the design study of a KRW gasifier-desulfurizer island for production of 125 MM Btu/day of SNG. Results included a 4 to 6% improvement in feedstock inputs when compared to an earlier GRI-sponsored study. Methane yield decreased but the number of operating gasifier-desulfurizers remained at five. Equipment costs are expected to remain well within the previous + or - 25% cost estimate.

2048 **The effect of system parameters on fines generation in limestone/coal char mixtures.** Sishtla, C.; Chan, I.; Findlay, J.; Knowlton, T.M. 28p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 162G.

This paper describes tests conducted in a high-temperature, 6-inch-(15-cm) diameter test unit and a high-pressure, 60-inch-(15-cm) diameter unit to determine the effect of gas density on the fines generation rate of -20+35 mesh mixtures of coal chars and limestone. Both bituminous and lignite coal chars were tested. Limestone concentrations of 20, 35, and 50 weight percent were used in the investigation. Data were obtained using a multi-hole gas distributor over a temperature range of 70 to 1400 degrees Fahrenheit (21 to 760 degrees Centrigrade) and a pressure range of 5 to 350 psig (34 to 2410 KPa).

2049 **An investigation of coal-oil reaction pathways using model compounds.** Kim, H.; Curtis, C.W. 28p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 167E.

The reactants in the coprocessing of coal with petroleum residuum are composed of two complex and diverse materials with coal being more aromatic with a low H/C ratio and residuum more aliphatic with a higher H/C ratio. In this paper the interactive chemistry between these diverse materials is investigated in both thermal and catalytic reactions using model reactant systems at coprocessing reaction conditions. The model systems are composed of aromatics, partially saturated aromatics and nitrogen, sulfur, and oxygen containing heteroatomic species. The catalyst used was an in situ generated MoS_{2+chl} whose precursors were Mo naphthenate or Mo octoate and elemental sulfur. Reaction products and pathways are determined for both thermal and catalytic reactions.

0105 By-products

2050 (PB–89-220966/XAB) **Detailed control technology survey of a coke-oven plant.** Sheehy, J.W. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering. Jul 1979. 37p. (ECTB–123-05B). Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

A coke-oven control technology field survey at a fully integrated steel facility was performed to determine exposure of workers to coal tar pitch volatiles (CTPV). Area and personal samples were collected for CTPV, and weather data were obtained from a nearby airport weather station. The airflow of the filter and air-conditioner units was measured in the lunchroom facility. Coke-oven benchmen throwing coal into the oven had a higher exposure when throwing coal over the side of the bench. Wind speed and direction had a major effect on top-side CTPV concentrations. The author recommends that area samplers be placed above at least every third coke oven door to effectively measure visible door emissions.

0106 Properties

Refer also to citation(s) 2015, 2017, 2023, 2097, 2099, 2100

2051 (CONF-891001–9) **Gas content in sealed Argonne Premium Coal Samples.** Vorres, K.S. Argonne National Lab., IL (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on coal science; Tokyo (Japan); 23-27 Oct 1989. Order Number DE90002862. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Argonne Premium Coal Samples in ampoules of 5 grams of −100 mesh and 10 grams of −20 mesh were periodically opened in vacuum and analyzed with a mass spectrometer as part of a quality monitoring program. The samples were originally sealed under nitrogen in a glove box maintained at less than 40 ppM of oxygen. Moisture present in the coal was kept in the samples as much as possible. Determinations of the gases were made and provide an opportunity to observe the changes due to transformations, release of dissolved gases or other processes in the samples. Changes in the gas content were observed and may be useful in interpreting a variety of phenomena. 1 ref., 2 figs., 1 tab.

2052 (CONF-891001–10) **Isotope labeling investigations in simulated coalification: A view of geological metamorphism.**

Botto, R.E.; Hayatsu, R.; Carrado, K.A.; Winans, R.E. Argonne National Lab., IL (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on coal science; Tokyo (Japan); 23-27 Oct 1989. Order Number DE90002863. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In the present work, conifer lignin samples that have been subjected to coalification to varying degrees have been examined by solid-state ^{1}H and ^{13}C nuclear magnetic resonance (NMR) spectroscopy to monitor chemical changes associated with their thermal maturation. The results are compared with similar data taken for eight Argonne Premium coals. In parallel experiments, a synthetic sample of [methoxy-^{13}C] lignin and m-(methoxy-^{13}C) toluene have been coalified under similar conditions and have been analyzed by ^{13}C NMR. 9 refs., 4 figs.

2053 (CONF-891046–4) **Advanced research in instrumentation and control technology.** Sheen, Shuh-Haw; Raptis, A.C. Argonne National Lab., IL (USA). Oct 1989. 19p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Advanced research and technology development; Morgantown, WV (USA); 3-5 Oct 1989. Order Number DE90002774. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this program is to conduct advanced research in instrumentation and diagnostic technology needed in coal combustion, pyrolysis, and cleanup processes. The program includes development of control instruments for specific process parameters such as flow rate, temperature, and viscosity, and also development of integrated diagnostic systems for unit process control. The present focus of the program is to develop an on-line ultrasonic viscometer for monitoring the rheological properties of coal slurry. This viscometer may be developed through measurements of acoustic impedance, attenuation, relaxation, and cavitation properties of the slurry being tested. Acoustic impedance and cavitation methods were examined in FY 1989.

2054 (DOE/ER/13777–2) **Prediction of thermodynamic properties of coal derivatives: Progress report, March 1, 1989–February 28, 1990.** Donohue, M.D. Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Chemical Engineering. Nov 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13777. Order Number DE90003355. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this report, we present our efforts and progress toward understanding molecular behavior and its effect on thermodynamic properties. To this end, we have developed a number of theories applicable to the types of molecules found in coal processing. To put out current work into context, we present here a brief review of our previous work. Initially the Perturbed Soft Chain Theory (PSCT), a perturbation theory for chain molecules based on the Lennard-Jones potential function was formulated. This was followed by the development of the Perturbed Anisotropic Chain Theory (PACT) which extended the applicability of PSCT to mixtures containing polar molecules. Next, PACT was generalized to include the effect of chemical association (hydrogen bonding) resulting in the Associated Perturbed Anisotropic Chain Theory (APACT). In order to reduce the mathematical complexity of these equations and hence increase their usefulness to practicing engineers, the Simplified Perturbed Hard Chain Theory (SPHCT), which is applicable to non-polar chain molecules, and COMPACT, an equation for hydrogen bonding fluids were developed. In addition to our theoretical work, experiments have been performed to study the phase behavior of binary, ternary and quaternary mixtures containing model coal compounds. Other experimental work involved measurements of selective solubility enhancement of coal chemicals in high-pressure fluids, the partitioning of a dilute solute between two solvents and spectroscopic measurements of chemical association. The various theories developed and experimental work performed under this research program during the current contract period are described briefly in the following sections.

2055 (DOE/PC/88922–4) **Supercritical fluid thermodynamics for coal processing: Quarterly progress report, July 1, 1989–September 30, 1989.** Eckert, C.A. Illinois Univ., Urbana, IL (USA). Dept. of Chemical Engineering. 15 Sep 1988. 5p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88922. Order Number DE90002766. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Because of their unusual solvating and mass transfer properties, supercritical fluids show potential for a variety of coal processing applications. We have established a database of coal model compound equilibrium and are beginning modeling efforts. In addition, we have used fluorescence spectroscopy to study the nature of the intermolecular interactions in the system of pyrene in supercritical C_2H_4. The spectroscopy measurements are being used to guide the development of an equation of state that can be used to predict the solubility behavior so systems can be designed for the processing of coal with supercritical fluids. 1 fig.

2056 (DOE/PC/88934–T3) **Enhancement of surface properties for coal beneficiation: Progress report, August 1, 1989–September 30, 1989.** Chander, S.; Aplan, F.F. USDOE Pittsburgh Energy Technology Center, PA (USA). [1989]. 5p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88934. Order Number DE90003039. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The main objective of this research program is to study ways to modify surface properties of coal, pyrite and ash-forming mineral matter for beneficiation of fine coal. Since the differences in surface properties of coal and mineral matter are utilized in several oil based preparation technologies, such as: froth flotation, emulsion flotation, spherical agglomeration and liquid-liquid separation, another objective is to delineate the role of oil. The role of oil can be as a surface modifying agent, an agglomerating medium (bridging liquid) or a collecting phase for coal particles.

2057 (DOE/PC/88941–T4) **A study of coal particle shape and three-body wear: Quarterly report, August–October 1989.** Clark, N.N.; Means, K.H. West Virginia Univ., Morgantown, WV (USA). Dept. of Mechanical and Aerospace Engineering. [1989]. 26p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88941. Order Number DE90002759. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effect of coal particle shape on the three body wear project has completed its first year. Several milestones in the project have been completed. The wear machine has been designed and built and is undergoing calibration runs at present. The particle shape study is well underway. An algorithm has been developed for shape description. 1 ref., 3 figs.

2058 (DOE/PC/89904–T4) **High-sulfur coal research at the SIUC [Southern Illinois University at Carbondale] Coal Technology Laboratory: Quarterly progress report, July 1–September 30, 1989.** Southern Illinois Univ., Carbondale, IL (USA). Coal Extraction and Utilization Research Center. Oct 1989. 135p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-89PC89904. Order Number DE90003310. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Research on high-sulfur coal at the Coal Technology Laboratory at Southern Illinois University at Carbondale (SIUC) is divided into three general categories: coal science, coal preparation, and coal utilization. The work in these three areas covers a broad spectrum of high-sulfur coal research, from the very fundamental aspects of coal, through its physical beneficiation, to its ultimate utilization. Individual projects are processed separately for the databases.

2059 (DOE/PC/90519–T11) **Electrochemical characterization and derivatization of coal: Final technical report, September 15, 1986–September 14, 1989.** Park, Su-Moon. New Mexico Univ., Albuquerque, NM (USA). Dept. of Chemistry. [1989]. 86p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90519. Order Number DE90002791. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Electrochemical characterization and derivatization studies have been carried out on several different New Mexico coal samples. Results indicate that coal can be oxidized electrochemically in alkaline solutions to produce humic acids at the anode and hydrogen at the cathode. Humic acids may be reductively hydrogenated or used as a soil conditioner to hold minerals and acidify soil in the southwestern region, whereas hydrogen could be used as a fuel. Various parameters affecting this reaction have been studied and the results

are discussed. When coal is reduced in nonaqueous solution with solution catalysts, such as anthracene or naphthalene, and proton donors, such as isopropyl alcohol present, it is hydrogenated and the H/C-ratio becomes higher. The results were confirmed both by elemental analysis and FTIR spectroscopy. While it was shown that these reactions can occur, it would take more work to make these reactions practical. Finally, theory of electrode processes has been developed in an effort to analyze the electrochemical current when coal is electrolyzed, or when a catalyst molecule is electrolyzed with coal slurries present in a solution.

2060 (DOE/PC/90521–T12) **Role of porosity in supercritical fluid extraction of coal: Final technical report.** Bale, H.D. North Dakota Univ., Grand Forks, ND (USA). Dept. of Physics. 2 Oct 1989. 28p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90521. Order Number DE90003322. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The major emphasis of our recent work has been directed towards establishing the role that the micropore structure plays in fluid extraction of coal. The project incorporated in situ small angle x-ray scattering experiments and online ultraviolet and infrared absorption measurements. The largest number of experiments were performed on Wyodak subbituminous coal from Clovis Point. The solvent used in the extraction experiments was tetrahydrofuran (THF) which was chosen because it was satisfactory for both the on-line ultraviolet measurements and the x-ray scattering system. Discussed in this report are the characteristics of extracted material; in-situ small angle scattering during fluid extraction, micropore formation at 380°C; the extraction process and pore filling of untreated coal. 8 figs. (CBS)

2061 (DOE/PC/90527–T8) **Characterization of oxidized coal surfaces: Final report.** Hercules, D.M. Pittsburgh Univ., PA (USA). Dept. of Chemistry. 25 Sep 1989. 64p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90527. Order Number DE90002400. Available from NTIS, PC A04/MF A01 - OSTI.

This report encompasses work in the development of mass spectrometry methodology for characterization of specific compounds formed during the surface oxidation of coal, a process that alters physical and chemical properties important in direct utilization and conversion of the coal. Modern microprobe mass spectrometry methods of Laser Mass Spectrometry (LMS) and Secondary Ion Mass Spectrometry (SIMS) have been used in this investigation in combination with selected derivatization reaction to achieve specific chemical characterization from the complex coal matrix. 32 refs., 27 figs., 4 tabs.

2062 (EGG-M–88261) **Numerical comparisons between the pyrolysis mass spectra of twelve US coals and their relative solubility in microbial cultures or alkaline buffer.** Yeh, G.J.C.; Ward, B.; Quigley, D.R.; Crawford, D.L.; Meuzelaar, H.L.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-880912–31: 196. American Chemical Society national meeting, Los Angeles, CA (USA), 25-30 Sep 1988). Order Number DE90002146. Available from NTIS, PC A02/MF A01 - OSTI.

Curie-point pyrolysis mass spectra of twelve low-rank US coals with various degrees of natural weathering were correlated with the results of biosolubility screening tests involving six selected microorganisms as well as with a specially designed alkaline solubility test. The main objective of this study was to determine which mass spectral characteristics, if any, correlate with the degree of biosolubility. The results indicate the possible presence of two biosolubilization trends, a main trend which correlates positively with the presence of severely oxidized aromatic moieties in the coal and apparently enables biosolubilization by all six microorganisms, and a second trend which correlates with relatively high concentrations of acid components and enables biosolubilization by only two or three of the organisms. The chemical and biological significance of these trends is not yet completely understood. Finally, in agreement with previous reports a strong positive correlation was observed between biosolubility and alkaline solubility. 10 refs., 7 figs., 4 tabs.

2063 (EGG-M–88469) **Relationships between natural weathering and lignite biosolubility or alkali solubility.** Ward, B.; Quigley, D.R.; Dugan, P.R. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-76ID01570. (CONF-881205–3: Symposium on coal, oil, and gas biotechnology, New Orleans, LA (USA), 5-7 Dec 1988). Order Number DE90002027. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Samples of weathered lignites collected from various outcrops or mine areas were biosolubilized to various degrees by two different fungi. Although apparent degree of weathering usually correlated directly with coal biosolubility, some of the most highly weathered lignites were the most resistant to microbial attack. This apparent anomaly was investigated by testing biosolubility of two different lignites collected from various depths into weathered seams. The surface layers, which appeared to be the most highly weathered, were less biosoluble than were samples taken from the next few centimeters into the seams. Biosolubility of deeper layers decreased with increasing seam depth. One of the coals was also tested for alkali solubility, and the resulting weathering-gradient solubility profile paralleled that of biosolubility. Chemical analyses revealed apparent direct relationships among coal oxygen content, apparent degree of weathering, and solubilization. Pretreatments with hydrochloric acid to extract metal ions resulted in enhanced alkali solubility of all samples but those from the deepest layer. Chemical analyses of acid-extracts indicated a role of metal cations in coal biosolubility. Formation of insoluble metal cation-oxidized coal complexes could reduce biosolubility (or alkali solubility) of weathered coals. 14 refs., 3 figs., 4 tabs.

2064 (ORNL/FTR–3458) **[Coal structure and basic reactions]: Foreign trip report, October 20, 1989–October 28, 1989.** Chambers, R.R. Jr. Oak Ridge National Lab., TN (USA). 7 Nov 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002963. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This document describes a trip to Tokyo, Japan, for the purpose of attending the 1989 International Conference on Coal Science and presenting a talk entitled "Coal Structural Inferences Derived from the Alkylation of Acidic C-H Bonds with $pK_a \leq 35'$. The areas of coal science that were highlighted during the conference were coal structure and characterization, basic reactions of coal, coal liquefaction, beneficiation, pyrolysis, gasification, and combustion. Presentations given in the sections on coal structure and characterization and pyrolysis were particularly relevant to the current coal research efforts in the Chemistry Division at ORNL. Additional benefit was possible from informal discussions with researchers whose interests are in the application of alkylation chemistry and NMR techniques for coal structure analysis.

2065 (ORNL/FTR–3459) **[Coal science]: Foreign trip report, October 20, 1989–October 31, 1989.** Buchanan, A.C. III. Oak Ridge National Lab., TN (USA). 9 Nov 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002964. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the 1989 International Conference on Coal Science, which covered a broad spectrum of topics in fundamental and applied coal science. Of particular interest and relevance to the DOE sponsored Organic Coal Chemistry Program at ORNL were symposia on Coal Structure and Characterization and Basic Reactions of Coal. The traveler presented a paper on his research to a large international audience, chaired a technical session, and participated in numerous informal discussions of benefit to the Coal Chemistry Program. Visits with staff at the technology centers indicated above provided insights into the current status of Japanese efforts in coal liquefaction and gasification.

2066 **Apparatus for direct measurement of ash fusion and sintering behavior at elevated temperatures and pressures.** Khan, M.R. (Texaco, Inc., P.O. Box 509, Beacon, New York 12508 (US)). *Review of Scientific Instruments (USA)*, 60(10): 3304-3309 (Oct 1989).

Ash fusion, sintering, and deposition may impose serious operational difficulties in conventional and advanced coal-combustion systems. Conventional ash fusion techniques (e.g., ASTM methods) determine the qualitative behavior of ash samples at atmospheric pressure. Presently, there is no known available technique that can measure the behavior of coal ash at elevated temperatures and pressures. In the literature, methods based on electrical resistance

or shrinkage of coal ash have been reported at atmospheric pressure (elevated temperatures) conditions. A high-pressure microdilatometer (HPMD) has been developed to investigate ash fusion and sintering behavior at elevated pressures and temperatures by the simultaneous measurement of the temperature of initial contraction and electrical resistivity of samples. This novel technique facilitates the measurement of ash properties over a wide range of temperature, pressure, and gas atmosphere (oxidizing, reducing, or inert). The operating principle of the HPMD includes measuring the temperature at which there is a significant "shift" in the electrical resistivity (and/or sample volume) that represents ash sintering and fusion. Sintering occurs through the formation of solid-state, particle-to-particle "necks" or the appearance of a molten phase, which allows a path for electrical conductance. The ability to perform both resistivity and shrinkage measurements simultaneously or independently at *elevated pressures* makes the HPMD truly unique. The HPMD can also be used to investigate the swelling and softening behavior of pyrolyzing coal at elevated pressures and relatively rapid heating rates.

0108 Waste Management

Refer also to citation(s) 2066, 2079, 2095, 2420, 2422, 2423, 2424, 2426, 2727, 2729, 2798

2067 (DOE/PC/79921–T6) **Pore structure and reactivity changes in hot coal gas desulfurization sorbents: Technical progress report, July–September 1989.** Sotirchos, S.V. Rochester Univ., NY (USA). Dept. of Chemical Engineering. Sep 1989. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79921. Order Number DE90001946. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The primary objective of the project is the investigation of the structural and reactivity changes occurring in metal/metal oxide sorbents used for desulfurization of hot coal gas during sulfidation and regeneration with particular emphasis placed on the effects of these changes on the sorptive capacity and efficiency of the sorbents. The following tasks have been identified in the project: (1) Conversion vs. Time Studies during Sulfidation and Regeneration; (2) Pore Structure Evolution Studies during Sulfidation and Regeneration; (3) Intraparticle Diffusion Studies; (3) Intraparticle Diffusion Studies; (4) Developments of Structural Models for Hot Coal Gas Desulfurization Sorbents; and (5) Development of Mathematical Models for Fixed-Bed Desulfurization Reactors. During the third quarter of the 1989 academic year, our research efforts primarily focused on Tasks 1, 2, and 3. 11 refs., 5 figs.

2068 (DOE/PC/91101–T8) **Sulfur dioxide removal from flue gases by supported copper and iron absorbents: Final technical report, May 16, 1986-December 31, 1988.** Melson, G.A. Virginia Commonwealth Univ., Richmond, VA (USA). Dept. of Chemistry. [1988]. 19p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC91101. Order Number DE90001400. Available from NTIS, PC A03/MF A01 - OSTI.

This project was initiated in response to a need to address the problem of attrition for copper oxide/alumina sorbents for the PETC fluidized bed copper oxide process. The attrition problem is a major drawback to the economic feasibility of the process. Previous attempts to reduce sorbent attrition focused on engineering modifications; however, it was proposed that the method of impregnation and pre-treatment of a copper oxide/alumina sorbent may have a significant effect on the reactivity and stability of the sorbent and thus the attrition rate. Prepared sorbents would be characterized by a variety of techniques. Sorption of sulfur dioxide from simulated flue gas mixtures and regeneration of the sorbents with hydrogen and methane would be studied, particularly by thermogravimetric techniques. Evaluation of the rate of attrition for the prepared sorbents would be made. 5 refs., 9 figs.

2069 (EPRI-GS–6540) **Use of ash in highway construction: Delaware demonstration project: Final report.** Srivastava, L.; Collins, R.J. Electric Power Research Inst., Palo Alto, CA (USA); Delmarva Power and Light Co., Wilmington, DE (USA); VFL Technology Corp., Malvern, PA (USA). c Nov 1989. 126p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

EPRI has initiated a broad-based research and demonstration program aimed at promoting the utilization of high volumes of coal ash in highway construction applications, such as road bases, subbases, embankments and backfills. Included within the EPRI program is a Delaware study involving the construction and performance monitoring of a demonstration project in which Class F fly ash was used as an embankment material within a new highway interchange project. The primary objective of this project was to construct and monitor the structural and environmental behavior of this embankment. Design and construction activities associated with this embankment are discussed in this report. The report also describes all tests and other activities related to background, construction and post-construction monitoring work on this project. The final results from all monitoring activities are summarized in this report. The monitoring data demonstrates that fly ash embankment material provides equivalent structural performance to that of granular borrow material. At the same time, the data confirms that fly ash is an environmentally acceptable alternative to natural soil when used in a highway embankment. 13 refs., 11 figs., 3 tabs.

2070 (EPRI-GS–6569-Vol.1) **FGD [flue gas desulfurization] damper guidelines: Volume 1, Fundamentals and survey results: Final report.** Smith, E.O.; Cannell, A.L.; Ferguson, A.W. Electric Power Research Inst., Palo Alto, CA (USA); Black and Veatch, Kansas City, MO (USA). c Nov 1989. 244p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Dampers have been a major problem in the operation of flue gas desulfurization (FGD) systems, causing frequent system shutdowns. FGD damper reliability is critical to maintaining high unit availability. The overall objectives of this project are to determine the reasons for damper problems experienced in FGD service and to formulate guidelines to alleviate these problems in new and retrofit FGD installations. To accomplish these objectives, electric utilities with operational FGD systems were surveyed to determine the types of dampers being used in FGD applications and observations based on operating experience with such applications. From the survey information, nine plants were selected for in-depth field inspection and investigation of operating experience. Damper equipment suppliers were also surveyed in order to benefit from their experience in designing and trouble-shooting damper equipment in FGD service. Damper fundamentals and results of field investigations and utility/supplier surveys are presented in Volume 1 of this report. Major problem areas are identified and operating successes are discussed.

2071 (EPRI-GS–6569-Vol.2) **FGD damper guidelines: Volume 2, Guidelines: Final report.** Smith, E.O.; Cannell, A.L.; Ferguson, A.W. Electric Power Research Inst., Palo Alto, CA (USA); Black and Veatch, Kansas City, MO (USA). c Nov 1989. 162p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Dampers have been a major problem in the operation of flue gas desulfurization (FGD) systems, causing frequent system shutdowns. FGD damper reliability is critical to maintaining high unit availability. The overall objectives of this project are to determine the reasons for damper problems experienced in FGD service and to formulate guidelines to alleviate these problems in new and retrofit FGD installations. To accomplish these objectives, electric utilities with operational FGD systems were surveyed to determine the types of dampers being used in FGD applications and observations based on operating experience with such applications. From the survey information, nine plants were selected for in-depth field inspection and investigation of operating experience. Damper equipment suppliers were also surveyed in order to benefit from their experience in designing and trouble-shooting damper equipment in FGD service. Damper selection guidelines, including a guide specification and information on operation and maintenance, are presented in Volume 2. The guidelines provide specific information to assist the engineer in selection of the type of dampers required for the FGD system, recommended materials of construction, and design and construction criteria. The guide specification can be used to develop

a procurement specification that thoroughly covers the technical requirements for the dampers and ensures that adequate information is obtained to permit rigorous evaluation of proposals.

2072 (ETDE-mf–0721863) **Basic investigation of mixtures consisting of binders and tailings from coal mining with regard to their applicability as building materials in the mining industry.** Ernst, L. Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen. 4 Mar 1988. 205p. (In German). Order Number DE90721863. Available from NTIS (US Sales Only), PC A10/MF A01.

The object of the laboratory tests carried out was to analyze to what extent processing tailings which are consolidated by binders meet the requirements on typical construction materials of the mining industry. After a detailed analysis of the tailings and the flotation tailings (mineralogical, petrographic, grain shape, grain size distribution, sensitivity to water) mixtures with water and cement as well as possibly additives and varying grain sizes were prepared and their consistency was determined. In the tests with hardened mixtures, most of the uniaxial compression tests were carried out with cylindrical test specimens and the influence of various quantities on the strength were analysed. The density of the test specimen, the water-cement ratio and the cement content have a considerable effect on the attainable strengths. In order to obtain extensive knowledge about the material properties of processing tailings consolidated by binders, triaxial compression tests were carried out in addition to uniaxial compression tests and tensile splitting and tensile bending strengths were determined. (orig./RB).

2073 (OY/PSTL-TIED–63) **Peat - Environment - Society. Part 2: Emissions from combustion of peat.** Paajala, J.; Kauppi, M. Oulu Univ. (Finland). Research Inst. of Northern Finland. 1989. 93p. (In Finnish). Order Number DE90719343. Available from NTIS (US Sales Only), PC A05/MF A01.

This research is studying emissions formed in combustion of peat and other fuels used in power plants, the formation mechanisms of emissions, and possibilities to reduce them. The aim of the research has also been to indicate the role of combustion of peat as a source of emissions in Finland. The portion of emissions formed in combustion of peat in Finland seems to be about the same as the portion of energy produced by combustion of peat of the total energy prodution. The development work in the field of combustion technology, directed to reduction technologies of nitrogen and sulfur oxides, is the main target in reduction of emissions. This report is a literature survey of emissions from peat and analogous fuels.

2074 (STEV-FBT–89-26) **Ammonia addition for NO_x reduction in fluidized bed boilers.** Aamand, L.E.; Leckner, B. Statens Energiverk, Stockholm (Sweden). 1989. 9p. (CONF-8803160–1: 1. European conference on industrial furnaces and boilers, Lisbon (Portugal), 21-24 Mar 1988). Order Number DE90719436. Available from NTIS (US Sales Only), PC A02/MF A01.

Ammonia is added to the gases in the combustion chamber of fluidized bed boilers in order to investigate its effect on the emission of nitrogen oxides. A stationary and a circulating fluidized bed boiler are used. In the stationary fluidized bed boiler an addition corresponding to a (NH_3/NO_{exit}) molar ratio of 3 gives a 50% reduction of the NO emission. Larger doses lead to escape of ammonia and other disadvantages. In the circulating fluidized bed boiler no effect from injection of ammonia into the combustion chamber is noted. The ammonia is decomposed. If NH_3 is to be used in circulating fluidized bed boilers it should be introduced in the particle-free gas after the particle separator.

2075 **Removal of acidic gases from incinerator flue gas in a fluidized bed scrubber.** Bradshaw, W.M.; Krishnan, R.P.; Young, J.M. 11p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 162E.

This paper describes a parametric study conducted in a 5-cm bubbling bed to determine the feasibility of scrubbing acidic gases from incinerator flue gas by direct contact with an alkaline sorbent in a fluidized bed. The effects of process parameters on removal of HCl, P_2O_5, and SO_2 were investigated experimentally. The relationship between removal efficiency and sorbent utilization was determined at 542°C (1000°F) and twice the minimum fluidization velocity.

2076 **A process for the preparation of cysteine from cystine.** Chang, S.G.; Liu, D.K.; Griffiths, E.A.; Littlejohn, D. To Dept. of Energy, Washington, DC. USA Patent 4,837,361. 6 Jun 1989. Filed date 18 Nov 1987. USA Patent Application 7 122,725. Int. Cl. C07C 147/02;C07C 149/24;C07C 149/243. 16p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an invention which in one aspect relates to a process for the simultaneous removal of NO_{cN} and SO_2 from a fluid stream comprising mixtures thereof and in another aspect relates to the separation, use and/or regeneration of various chemicals contaminated or spent in the process. It includes the steps of: Contacting the fluid stream at a temperature of between about 105° and 180°C with a liquid aqueous slurry or solution; separating the fluid stream from the particulates formed; washing and separating the particulates with an aqueous solution having a pH value of between about 5 to 8; subsequently washing and separating the particulates with a strongly acidic aqueous solution; washing and separating the particulates with a basic aqueous solution; optionally adding additional amino acid moiety, iron (II) and alkali to the aqueous liquid to produce an aqueous solution or slurry having a pH value of between about 4 to 12; and recycling the aqueous slurry of the last step to the contacting zone of the first step.

0109 Environmental Aspects

Refer also to citation(s) 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2050, 2422, 2798

2077 (DOE/FE/60850–T1) **[Analysis of acid rain and associated phenomena]: Final report.** General Sciences Corp., Laurel, MD (USA). Sep 1989. 14p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC01-85FE60850. Order Number DE90002555. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Department of Energy, Office of Fossil Energy, Office of Coal Utilization, Advanced Conversion and Gasification (OCUAC&G) is and has been engaged in numerous research and development programs which will greatly increase the use of coal and other abundant fossil energy resources. In combination, these technology programs and energy systems characterize OCUAC&G's approach to accomplishing their strategic objectives of: clean coal, new fuel forms for coal, new coal utilization processes, coal gasification, modular equipment systems, and environmental protection. Under this contract, GSC is to assist OCUAC&G in meeting their strategic objective by providing services related to three task areas: literature surveys, acid rain analysis, and interfacing of energy systems. During this period considerable attention was paid to performing literature surveys, analysis of emissions and deposition data, and the review of energy systems. Notable accomplishments are summarized below. 5 figs.

2078 (EPRI-GS–6578) **1988 interorganizational workshop on future utility SO_2 emissions.** McGowin, C.R.; Veselka, T.D.; Vankuiken, J.C.; Pechan, E.H.; Holmes, C. Electric Power Research Inst., Palo Alto, CA (USA); Argonne National Lab., IL (USA); Pechan (E.H.) and Associates, Inc., Springfield, VA (USA); National Coal Association, Washington, DC (USA). c Nov 1989. 63p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Interim Assessment, published in 1987 by the National Acid Precipitation Assessment Program (NAPAP), compared model predictions of future utility SO_2 emissions in the US prepared by several organizations. The principal investigators responsible for the SO_2 emissions predictions met at two workshops during 1988 to develop an understanding of the logic and understanding of the models and to assess the uncertainties and impacts of the assumptions on future utility SO_2 emissions. The participants included representatives from Argonne National Laboratory (ANL), EPRI, NAPAP, National Coal Association (NCA), E.H. Pechan and Associates (Pechan), US Department of Energy (DOE), and US Environmental Protection Agency (EPA). The EPRI, EPA/Pechan, and ANL utility SO_2 emissions model predictions were compared over the period

1980 to 2050 using a uniform test case assumption set. All three models predicted that utility SO_2 emissions would decline to five million tons/year by 2040 under the test case assumptions. 5 refs., 12 figs., 12 tabs.

2079 (RRTAC–89-2) **Proceedings of the conference: reclamation, a global perspective.** Walker, D.G.; Powter, C.B.; Pole, M.W. (comps.). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. 2 vols., 872p. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

A total of 86 papers are presented in the proceedings: they come from conference sessions with the following titles - reclamation, a global perspective; northern and high altitude reclamation; fish and wildlife and rangeland reclamation; water; herbaceous revegetation; woody plant revegetation and succession; industrial and urban sites; problems and solutions; sodic and saline materials; soils and overburden; and acid generating materials - and a mine tailings reclamation symposium. 34 of the papers have been abstracted separately.

2080 **Environmental aspects of coal-fueled diesel engines.** Williams, M.C. (USDOE Morgantown Energy Technology Center, WV (USA)); Holcombe, N.T.; McMillian, M. vp of Advances in engine emissions control technology. Chrisman, B. Serve, J.V. American Society of Mechanical Engineers, New York, NY (1989). (CONF-8901105–: Advances in engine emissions control technology, Houston, TX (USA), 22-25 Jan 1989).

Conventional diesel engines are considered by some to be contributors to environmental problems since they emit NO_{chl}, a suspected acid rain precursor. Initial testing has shown that CWS-fueled diesels emit substantially reduced NO_{chl} emissions. While emissions of particulates and SO_{chl} may be potentially higher with coal fuels, assessment of the control technology indicates excellent potential for meeting existing and future standards for these emissions. As a result of activities managed by the Morgantown Energy Technology Center, the economic and technical feasibility of CWS-fueled diesel engines has been determined. The objective of this paper is to discuss the environmental concerns, emission goals, and the control methodologies, devices and strategies that will be used to ensure CWS-fueled diesel engines will meet current and potential environmental standards.

0110 Reserves and Exploration

2081 (ETDE-mf–0718167, pp. 43-66) **Technical and economic factors influencing the exploration of black-coal deposits in developing countries.** Stolte, G. (Montan-Consulting G.m.b.H., Essen (Germany, F.R.)). Technische Univ. Berlin (Germany, F.R.). 1987. (In German). In *Festive colloquium to celebrate the 70th anniversary of Prof. em. o. Dr.-Ing. Friedrich Adler. Berlin, October 17, 1986.* Order Number DE90718167. Available from NTIS (US Sales Only), PC A06/MF A01.

The author gives an insight into the problems in the planning and exploration of black-coal deposits with which international mining consultants are faced in their daily work in developing and threshold countries. He discusses the importance of coal for developing countries, the exploration, opening-up and lay-out of coal deposits, technologies matched to specific conditions, profitability, project management and training required for local staff. (MOS).

2082 (ETDE-mf–0718167, pp. 67-92) **Special problems in the exploration and operation of loose-rock open-pit mines in developing and threshold countries.** Gallisch, J.H. (Rheinbraun-Consulting GmbH, Koeln (Germany, F.R.). Abt. Projektwesen). Technische Univ. Berlin (Germany, F.R.). 1987. (In German). In *Festive colloquium to celebrate the 70th anniversary of Prof. em. o. Dr.-Ing. Friedrich Adler. Berlin, October 17, 1986.* Order Number DE90718167. Available from NTIS (US Sales Only), PC A06/MF A01.

The world-wide activities of RHEINBRAUN-Consulting, a RHEINBRAUN AG subsidiary, in the field of open-pit mining technology is reported briefly. As a consulting company, it is concerned with the exploration and assessment of deposits, opening-up feasibility studies, the process of opening-up proper, the installation of required operational infrastructure, the structuring of operation in line-type management, subsequent in-service consulting, handover to operator/project organizer. The author reports experience gained in Asia, Latin America and Southern Europe. Special reference is made to the introduction continuous mining and conveying technology, to technology transfer and mastering of the 'new' technology by the operator/project organizer complete with the necessary planning implications. (MOS).

0120 Mining

Refer also to citation(s) 2072, 2079, 2082

2083 (DOE/PC/88939–5) **Methane drainage from gassy Western US coal seams.** Hucka, V.J.; Bodily, D.M. Utah Univ., Salt Lake City, UT (USA). Dept. of Mining Engineering. 1989. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88939. (CONF-891018–1: MMIJ/IMM joint symposium on today's technology for the mining and metallurgical industries, Kyoto (Japan), 2-4 Oct 1989). Order Number DE90002801. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Methane gas retained in gassy coal seams is a valuable source of clean energy. However, methane is also a potential safety hazard. Its removal prior to mining improves mine safety by reducing the potential for explosions as well as economics by decreasing ventilation costs. A method of field evaluation of methane content in some Western US coal seams is presented. Results of pre-mining degasification in seams of similar methane content are described. The results indicate that degasification, or methane drainage, depends heavily on coal permeability. Since the permeability is affected by the presence of joints, fractures and cleats in coal and associated strata, their influence on the optimum direction of boreholes was studied. The results of methane drainage are discussed and recommendations as to the orientation of boreholes with respect to the main cleat systems in coal are suggested. 18 refs., 8 figs., 2 tabs.

2084 (DOE/PC/88947–T4) **Development and utilization of new diagnostics for dense-phase pneumatic transport: Quarterly technical progress report, July 1, 1989–September 30, 1989.** Louge, M.Y.; Jenkins, J.T. Cornell Univ., Ithaca, NY (USA). 1989. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88947. Order Number DE90003370. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Dense-phase pneumatic transport is an attractive means of conveying solids. Unfortunately, because of the high solid concentrations, this transport method is a difficult regime in which to carry out detailed measurements. Hence most details of the flow are unknown. In this context, the main objective of this work is to develop probes for local measurements of solid velocity and holdup in dense gas-solid flows. In particular, capacitance probes are designed to measure local, time-dependent particle concentrations. In addition, a new optical fiber probe based on laser-induced-phosphorescence is developed to measure particle velocities. 2 refs., 10 figs.

2085 (ETDE-mf–0718167) **Festive colloquium to celebrate the 70th anniversary of Prof. em. o. Dr.-Ing. Friedrich Adler. Berlin, October 17, 1986.** TUB-Dokumentation Kongresse und Tagungen. Technische Univ. Berlin (Germany, F.R.). 1987. 120p. (In German). Order Number DE90718167. Available from NTIS (US Sales Only), PC A06/MF A01.

A festive colloquium was held at the TU Berlin to celebrate the 70th anniversary of Prof. em. o. Dr. Ing. Friedrich Adler. The subjects of the papers were: Technical and economic aspects in the exploration of black coal deposits, loose-rock open-pit mining in developing countries, today's situation of the mineral oil industry, and research and teaching at university. Three papers were abstracted for entry into the data base. (MOS).

2086 (ETDE-mf–0718193) **VG annual report 1988. Activity report of the Versuchsgrubengesellschaft mbH, Versuchsgrube Tremonia in Dortmund.** Versuchsgrubengesellschaft m.b.H., Dortmund (Germany, F.R.). Versuchsgrube Tremonia. 1989. 118p. (In German, English). Order Number DE90718193. Available from NTIS (US Sales Only), PC A06/MF A01.

It is reported on the investigations and tests carried out in 1988, concerning: Explosions, blasting, mine fires, winding, mechanical engineering, measuring and data processing. (HS).

2087 (OPTIMITURVE–2) **Development of a moisture meter for milled layer.** Aho, V.J.; Leinonen, A.; Hyvaerinen, T. Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Polttoaine- ja Polttotekniikan Lab. 1989. 23p. (In Finnish). Order Number DE90719330. Available from NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

The purpose of the present paperis to report the development of a continuously operating moisture meter for milled peat layer. The moisture meter is based on the NIR (Near Infra-red) reflection measuring technique. The meter's detector consists of a Near Infra-red radiation detector, elements for optical measuring, a two-channel Infra-red detector, and an electronic signal processor. This moisture meter system also contains a field operable microcomputer for storing measurement data and a printer for taking print-outs during the measurements. The detector and its accessories are installed onto a carriage which can be pulled along on a bog. The results from various measuring tests, and the differences between these results and the results obtained from measuring samples taken by hand are reported. In addition, the paper describes experiences received from using the homogenization equipment. An lastly, plans for further development of the continuously operating and field operable moisture meter for milled layer are outlined.

2088 (OPTIMITURVE–3) **Calculation of peat production expenses.** Hillebrand, K.; Ahonen, M. Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Polttoaine- ja Polttotekniikan Lab. 1989. 24p. (In Finnish). Order Number DE90719329. Available from NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

In this publication costs of different milled and sod peat production methods are examined. Five different production methods, Haku, ridging, medhanical harvester, tractor-driven pneumatic harvester, and self-propelled pneumatic harvester methods have been compared in milled peat production, and Haku and harvester methods in sod peat production, respectively. Using the developed spread-sheet software on can readily examine the effects of initial values, e.g. machine working capacity or composition of units, on production costs. The graphs obtained from the program may be used to illustrate the cost differences between different production methods. It is also possible to determine the most potential research subjects, by which the final target of OPTIMITURVE peat research program may be achieved.

2089 (OPTIMITURVE–5) **Development of a mesuring method for the efficiency of milled peat production.** Lindh, T. Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Polttoaine- ja Polttotekniikan Lab. 1989. 15p. (In Finnish). Order Number DE90719331. Available from NTIS (US Sales Only), PC A03/MF A01.

OPTIMITURVE Research Program.

Measuring methods for determination on efficiency on utilization on weather conditions on peat production are studied in this publication. In the future the aim will be in developing of the measuring method so that the effects of the OPTIMITURVE research program on changes of productivity can be evaluated. Two mehtods were examined in this research. The proposed object for development is a model based on a Soviet estimation method for the annual changes of the seasonal yields. The proposed method is based on studying a long period data from weather and seasonal yields. Differences between different summers and a duration of the rain and its intensivity are considered in the method. Descriptions of the methods including examples and facts effecting on the accuracy of the methods and needs for development are presented in the report.

2090 (OPTIMITURVE–6) **Development of the method for measuring the thickness of a milled peat layer.** Lind, T.; Aho V.J. Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Polttoaine- ja Polttotekniikan Lab. 1989. 47p. (In Finnish). Order Number DE90719332. Available from NTIS (US Sales Only), PC A03.

OPTIMITURVE Research Program.

Measuring methods for continuous measuring of the thickness of a milled peat layer have been studied in this report. The aim was to find a measuring method for research use and to study different possibilities of how does the measuring device work in peat production. Ultra-sound technique was chosen for research and development work. Results of tests using a laboratory device are presented in the report. Parameters effecting on the measuring accuracy and the repetitivity of measurements were tested by using the device. In addition to this the effects of the inclination of the sensors and moisture content of milled peat on the measuring accuracy were tested. Also facts for additional tests and possibilities to develope the method for a field test equipment are presented.

2091 (PB–89-223853/XAB) **Use of foaming mud cement to terminate underground coal fires and to control subsidence of burn cavities. Final report.** Lucero, R.F. Colloidal Contrete Corp., Golden, CO (USA). 29 Sep 1988. 149p. Available from NTIS, PC A07/MF A01.

Foaming Mud Cement (FMC) is a class of materials related to cellular cement studied and developed for the purpose of addressing Abandoned Mine Land problems. During the 2-year program, significant advances were made using a specific methodology that properly employed will enable the successful termination of many surface and underground coal mine fires. Fundamental but key developments attained were: the ability to effectively isolate burning coal from the available air by effectively penetrating burning coal rubble with heat-resistive FMC and encapsulating and isolation of a wide range of coal particle sizes, resulting in permanent coal-fire termination by air exclusion. The materials developed were specifically designed to terminate underground coal fires and preventing further subsidence.

0140 Combustion

Refer also to citation(s) 2064, 2428, 2429, 2798, 2799, 3115, 3466

2092 (ANL/PPRNT–89-193) **On the topic of single and multicomponent chemisorption isotherms.** Hajduk, J.C. Argonne National Lab., IL (USA). [1989]. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. Order Number DE90003009. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The following presents the mathematical analysis leading to a general hypergeometric chemisorption isotherm. The correspondence between the limiting cases of this expression and others in the literature is noted. Representative molecular parameters for the interaction of alkali species with a hypothetical cation oxide surface are also given. 8 refs., 1 tab.

2093 (CONF-890437–13) **Metal wastage analysis of carbon steel tubes in FBC environment.** Sethi, V.K.; Puentes, E.; Natesan, K. Argonne National Lab., IL (USA). Nov 1988. 16p. Sponsored by U.S. DOE Fossil Energy; Tennessee Valley Authority. DOE Contract W-31109-ENG-38. From Corrosion '89; New Orleans, LA (USA); 17-21 Apr 1989. Order Number DE90002256. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The TVA 20-MW AFBC Pilot Plant located near Paducah, Kentucky began operations in March 1982, and it operated with the same in-bed evaporator tubes (tube bundle B1) for ~13,625 h through the end of 1985. During January–February 1986, the evaporator tubes were removed to test a new tube bundle configuration (tube bundle C1). After only a short period of operation, tube diameter measurements showed that tube wastage rates for bundle C1 were almost an order of magnitude larger than those recorded for B1. Although several other changes could have been responsible for this increase, the consensus at the TVA was that the increase probably occurred because the pilot plant switched coals from a low chlorine (0.02%) to a high chlorine (~0.30%) KY #9 coal. In order to determine the validity of the role of chlorine in increasing the tube wastage, several tube sections were cut out from the plant and analyzed at the Kentucky Energy Cabinet Laboratory (KECL) and at Argonne National Laboratory (ANL). The results of the chemical and metallographic examination showed that wastage could be attributed to erosive wear of chlorine-impregnated iron oxide scales. Corrosion component (oxidation) could have been altered by the

presence of elements such as chlorine, sulfur, and potassium in the combustion gases. The results also showed that, in order to understand the complex deposition/corrosion phenomena that occur in FBC systems, it is imperative to characterize the local environment in the vicinity of the tube bundles. 5 refs., 16 figs.

2094 (CONF-8906246–1) **Is there a strange attractor in a fluidized bed?.** Tam, S.W.; Devine, M.K. Argonne National Lab., IL (USA). [1989]. 5p. Sponsored by U.S. DOE Fossil Energy; Electric Power Research Institute. DOE Contract W-31109-ENG-38. From Quantitative characterization of dynamical complexity in nonlinear systems workshop; Bryn Mawr, PA (USA); 22-24 Jun 1989. Order Number DE90002206. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Fluidized beds have long been used as multiphase reactors in the chemical processing industries and as fossil-fuel combustion beds in the energy production industries. Depending on the extent to which the fluid flow velocity V exceeds U_{mf}, the fluidized bed can be in different flow regimes. In the regimes of interest (including the so-called bubbling, slugging and turbulent regimes), the fluidized-bed flow parameters tend to fluctuate in time. The flow parameters include particle velocities, pressure, and porosities. The presence of porosities (or voidage) to different extents is a common characteristic of these flow regimes. We have employed a combination of nonlinear dynamical techniques on a relatively large data set for fluidized bed pressure fluctuation. 9 refs., 4 figs.

2095 (DOE/MC/25151–2745) **Test plan for valveless ash removal from pressurized fluid bed combustion systems.** Hauserman, W.B. North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center. Jul 1989. 26p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-89MC25151. Order Number DE90000401. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is a test plan to demonstrate a method of ash removal from pressurized fluid bed combustion (PFBC) systems through small beds of crushed rock rather than conventional pressure let-down valves and lock hoppers. The economic advantage of such a method is that process-inherent erosive damage will be inflicted upon the cheaply replaceable crushed rock, rather than upon expensive, fabricated valve trim components. The concept to be tested is an extension of the "gravel bucket" principle in which an erosive, high pressure slurry stream passes through a bed of crushed rock with an adjustable flow path and cross-section. The original gravel bucket concept was inspired by the costly valve erosion problems projected for coal liquefaction plants. This project extends the same approach to systems where solids are to be removed from PFBC systems, with more limited possibilities of application to some coal gasification processes. If proven successful, a hot-gas gravel bucket could offer an economic alternative to a lock hopper plus a pair of expensive block valves. 6 refs., 10 figs., 1 tab.

2096 (DOE/PC/79902–T1) **In-situ measurements of coal ash deposit optical properties: Final report, September 11, 1987–September 30, 1989.** Clark, G.A.; Holmes, M.J.; Vecci, S.J.; Bailey, R.T. Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Aug 1989. 111p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79902. Order Number DE90000641. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A 6 million-Btu/hr pilot-scale combustor was operated to produce coal ash deposits from Kentucky No. 9 and Illinois No. 6 coals. Three types of deposits were formed: initial powdery, sintered, and fused. By means of an optical probe designed as part of this contact, infrared radiation from powdery and sintered deposits was measured in-situ as a function of wavelength. This data and temperature data were used to determine deposit spectral emittances. Samples of ash deposit were also removed from the slagging panel for laboratory measurement of their emissivities. Both coals produced deposits with total emittances typically between 0.5 and 0.9. The emittances of the powdery deposits were in the lower portion of the range. The emittances of the fused deposits were in the high end of the range. The sintered deposit emissivity was mid range. The emittances measured in the laboratory were consistent with those measured in situ. This project developed a means of making in-situ measurements of the emittances of ash deposits formed in pulverized-coal-fired combustors. 7 refs., 20 figs., 9 tabs.

2097 (DOE/PC/79906–T2) **Laser diagnostics of mineral matter and combustion processes in coal: Research report, September 1, 1988–January 31, 1989.** Venkateswarlu, P.; George, M.C.; Sekhar, P.C.; Subbarao, V. Alabama A and M Univ., Normal, AL (USA). 1989. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79906. Order Number DE90002870. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This is the third report on this project. During the period covered by the first two reports (October 1, 1987 through August 30, 1988) a sample of low sulfur powdered coal was heated under vacuum from 25 to 1000°C at a heating rate of 5°C per minute. The vapors generated were analyzed by a Balzer Quadrupole Mass Spectrometer model QMG 511. The analysis showed that the major constituents of the vapors are aliphatic hydrocarbons. A second set of experiments were carried out to determine the mineral constituents in ash obtained by heating coal in a porcelain crucible at 400–500°C in a muffle furnace until all the coal was oxidized. Model 3030 Perkin Elmer Atomic Absorption Spectrophotometer was used with appropriate hollow cathode lamps. A dozen elements were identified. Al, Na, K and Fe were the most prominent. During this period we have made an extensive series of measurements on laser induced combustion of coal pellets made from coal powder. C_2, CN, CO, Na and K were identified from the spectra. We have also fabricated a burner for the study of coal combustion using laser spectroscopic techniques. 1 ref., 4 figs.

2098 (DOE/PC/88900–5) **An engineering model for coal devolatilization: Quarterly report, March 15, 1989–June 15, 1989.** Lau, Chun Wei; Niksa, S. Stanford Univ., CA (USA). High Temperature Gasdynamics Lab. Sep 1989. 31p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88900. Order Number DE90003043. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There are three distinct modeling projects in this program: (1) an expedient reaction model for coal devolatilization for large scale combustor simulators; (2) a theoretical framework to explain the behavior of different coal types; and (3) an analysis of the chemistry, heat and mass transport in the vicinity of individual coal particles, to begin to describe the initial stages of the combustion of entrained coal particles. In the third activity, the transport analyses of devolatilizing and oxidizing coal particles, a two-component model which resolves tar and noncondensibles was formulated this quarter, and implemented in a computer simulator; this model is called the AEM3. The flux of tar and noncondensibles is now described with FLASHTWO, our engineering kinetics model. The AEM3 resolves tar and noncondensibles and illustrates the disparate growth rates of their concentration profiles. The AEM3 simulations also convey interesting implications for ignition mechanisms. Most importantly, resolving the tar and noncondensibles seems to considerable clarify homogeneous ignition mechanisms. 4 refs., 7 figs., 2 tabs.

2099 (ECN–220) **Review on mineral matter transformations and slagging in pulverized coal combustion.** Ten Brink, H.M. Netherlands Energy Research Foundation, Petten (Netherlands). Apr 1989. 73p. (MMT–0). Order Number DE90722329.

A survey is presented of the transformations that the mineral matter in coal undergoes during combustion. In chapter 1 the pheno enon of slagging is introduced and a short outline is given of the fate of the mineral matter during pulverized coal combustion. Also the major references, which are used for the report, are categorized and critically commented upon. A description of the general fate of the mineral matter in the coal combustion process is presented in chapter 2. In chapter 3 the transformation that the minerals undergo in a standard furnace are described. In chapter 4 a review is given of the present-day knowledge on slag deposit formation. Chapter 5 presents conclusions, critical comments and suggestions for improvement of the knowledge on slagging. 15 figs., 24 refs., 8 tabs., 1 app.

2100 (ECN–222) **Mineral matter transformations and slagging in a semi-industrial furnace.** Ten Brink, H.M.; Hamburg, G.;

Vleeskens, J.M.; Smart, J.P.; Dugue, J. Netherlands Energy Research Foundation, Petten (Netherlands). Aug 1989. 95p. (MMT–1). Order Number DE90722330.

A three-day slagging trial, which has been performed in the 2.5 MW semi-industrial sized IFRF (International Flame Research Foundation) Furnace No. 1, is described. In this trial the build-up of ash deposits on deposit probes has been followed while simultaneously the transformations of the coal-ash minerals in the furnace were monitored. The objective of this trial was to relate the nature of the deposits to the changes in the minerals prior to deposition. In this way the mechanism of deposit formation should be further clarified. However, the trial was performed on a scale that the results would also reveal which of the furnace parameters are central in deposit formation in full-sized furnaces. It was thus anticipated that the trial would also provide information on an empirical level to be used in the improvement of design and operation of full-sized boilers with respect to slagging. The slagging trial (MMT-1) formed part of the mineral matter transformation (MMT) project within the IEA-CCS program, Annex 2. The basis of the MMT project is the identification by the IEA Coal Industry Advisory Board of in-furnace deposition of ash (better known as slagging) as a major problem area in pulverized coal firing. 34 figs., 20 refs., 4 tabs., 3 apps.

2101 (STEV-FBT–89-27) **Heat transfer in circulating fluidized bed boilers.** Johnsson, F.; Andersson, B.Aa.; Leckner, B. Statens Energiverk, Stockholm (Sweden). 1989. 12p. (CONF-8805338–: Minsk international heat and mass transfer forum, Minsk (USSR), May 1988). Order Number DE90719437. Available from NTIS (US Sales Only), PC A03/MF A01.

The aim of the work is to measure the heat transfer to the walls of the combustion chamber of a CFBB and to analyze the results by means of a mathematical model. Furthermore, a comparison is made with available heat transfer data found in the literature. 16 refs., 2 tabs.

0150 Marketing and Economics

Refer also to citation(s) 2081

2102 (DOE/FE–0141) **The directory of US coal and technology export resources.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Planning and Environment. Oct 1989. 265p. Sponsored by U.S. DOE Fossil Energy. Order Number DE90001792. Available from NTIS, PC A12/MF A01 - OSTI; GPO Dep.

The purpose of this directory is to provide a listing of available US coal and coal related resources to potential purchasers of those resources abroad. The directory lists business entities within the United States which offer coal related resources, products and services for sale on the international market. Each listing is intended to describe the particular business niche or range of product and/or services offered by a particular company. The listing provides addresses, telephones, and tele/fax for key staff in each company committed to the facilitation of international trade. The content of each listing has been formulated especially for this directory and reflects data current as of the date of this edition.

0160 Health and Safety

Refer also to citation(s) 2091, 3678

2103 (ETDE-mf–0722093) **Shaping of working conditions for handicapped persons according to results of human-engineering research in hardcoal mining - main phase. Final report.** Hesse, D.; Bluemke, D.; Tulowitzki, H. Ruhrkohle A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Oct 1986. 73p. (In German). BMFT 01 VS 242 A/1. Order Number DE90722093. Available from NTIS (US Sales Only), PC A04/MF A01.

The problem how to employ severely handicapped persons gains increasing importance for mining. The reason therefore is partially found in the unfavourable age structure of the staff of this industry and the fact that the impact of handicaps increases with advancing age of staff so that the persons concerned can no longer meet the requirements of their job. The project aims at development and testing of a practice-orientated concept to integrate handicapped (by occupational decease, accident at work, or illness) into the personnel deployment in a way that capacities and job requirement are matched. Within the project, model jobs are to be developed and guidelines are to be drafted containing the criteria of working conditions according to human-engineering principles. The corresponding conditions are to be created for new jobs as well as for existing jobs which need to be modified. In addition, questions of training and continued formation of handicapped staff will be considered. (orig.).

2104 (ETDE-mf–0722301) **Investigation of explosion with delayed start ($\geq$ 150 m) and methods of prevention. Final report.** Michelis, J. Versuchsgrubengesellschaft m.b.H., Dortmund (Germany, F.R.); Commission of the European Communities, Brussels (Belgium). Directorate for Social Affairs. 30 Jun 1987. 114p. (In German). Order Number DE90722301. Available from NTIS (US Sales Only), PC A06/MF A01.

In the course of this research programme, more than 100 large-scale explosion experiments were carried out in the explosion-proof test gallery R3 of Tremonia test mine, which is equipped with all the necessary measuring facilities. The experiments were either carried out without any explosion protection measures, or with water tank explosion protection systems. With water tank protection, the flame range could be reduced by more than a factor of 2 as compared with the unprotected experiments. The experimental procedure and results are described in detail. (MOS).

02 PETROLEUM

Refer also to citation(s) 2612

0202 Geology and Exploration

Refer also to citation(s) 2116

2105 (LBL–27846) **WES, a robust expert system for well test analysis.** Mensch, A.; Benson, S.M. Lawrence Berkeley Lab., CA (USA). Sep 1989. 25p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC03-76SF00098. (CONF-8812107–1: Fall meeting of the American Geophysical Union, San Francisco, CA (USA), 4 Dec 1988 - 8 dec 1989). Order Number DE90003273. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Well tests are generally performed to determine the hydrologic properties of aquifers, petroleum reservoirs and underground waste disposal sites. There are many types of well tests, however, for the purposes of this paper, we consider two of the most common: pressure draw-down tests (production of a well at a constant flow rate) and pressure build-up tests (shut-in of a well after a production period). For both of these tests, the pressure changes in the wellbore are monitored for the duration of the test. The resulting data set consists of pressure versus time values, along with the corresponding flow rate data. WES is an expert system developed for well test analysis which combines data processing and graphic representations with the expertise that can be provided by an expert system. The new possibilities offered by an expert system in the field of automatic well test analysis are discussed. 22 refs., 11 figs., 3 tabs.

2106 (OCS/MMS–89-0058) **Federal offshore statistics, 1987: Leasing exploration, production, and revenues.** Harris, W.M.; Thurston, L. (comps.). Minerals Management Service, Herndon, VA (USA). [1989]. 97p. Sponsored by U.S. Department of the Interior. Available from OSTI - US Dept. of Interior, Office of Offshore Information and Publications, Minerals Management Service, Mail Stop 642, 381 Elden Street, Herndon, VA 22070.

This sixth edition of the Federal Offshore Statistics reports the mineral leasing, exploration, and production activities on the submerged lands and seabeds of the Nation's Outer Continental Shelf (OCS), as of December 31, 1987. This edition also includes selected State offshore statistics provided by the coastal States.

0203 Drilling and Production

Refer also to citation(s) 2123, 2156

2107 (BNL–43128) **Interaction between thermophilic microorganisms and crude oils: Recent developments.** Premuzic, E.T.; Lin, Mow S. Brookhaven National Lab., Upton, NY (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890884–2: Bioprocessing of fossil fuels workshop, Arlington, VA (USA), 8-11 Aug 1989). Order Number DE90003262. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A considerable research effort in the area of microbially enhanced oil recovery (MEOR) has shown that it is promising, and that a recovery biotechnology may be developed. Successful biochemical processes would have to be cost effective and have certain properties, such as being able to produce emulsifying agents and acidify the media. Further, the microbes producing these conditions should also be tolerant of high salt concentrations and be capable of metabolizing high molecular weight compounds. Since oil reservoirs are also subject to temperature and pressure variations, successful microbial strains should also be able to adapt to such environments. Thermophilic microorganisms, which usually live in harsh environments, appear to be good candidates for MEOR. Continuing work in this laboratory dealing with the chemistry and biochemistry of microorganisms living under extreme conditions has been expanded to a systematic study of the interaction of thermophilic microorganisms with crude oils and oil derivatives. Some recent results of these studies are presented. 15 refs., 5 figs., 1 tab.

2108 (CONF-8811286–Absts.) **Crude oil emulsions. Abstracts.** Institut fuer Erdoelforschung, Clausthal-Zellerfeld (Germany, F.R.). 1988. 11p. (In German). From IFE colloquium on crude oil emulsions; Clausthal-Zellerfeld (Germany, F.R.); 25 Nov 1988. Order Number DE90721817. Available from NTIS (US Sales Only), PC A03/MF A01.

On the occasion of this colloquium six lectures were held on the above-mentioned topic. These lectures dealt with composition, structure and transport behaviour of oil/water and water/oil emulsions, especially with the influence and effect of demulsifiers. (RB).

2109 (DOE/SF/00098–T14) **The influence of texture on steady foam flow in Berea sandstone.** Ettinger, R.A.; Radke, C.J. California Univ., Berkeley, CA (USA). Dept. of Chemical Engineering. Oct 1989. 31p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC03-76SF00098. Order Number DE89000771. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have studied the quantitative role of bubble size in the steady flow of strong foam through a 0.8-μm^2 Berea sandstone. Inlet and outlet textures are determined from photomicrographs taken of bubbles flowing through specially designed visual cells. Concurrent measurements of pressure profiles and liquid saturation profiles by microwave attenuation are acquired for gas velocities ranging from 1 to 3 m/day and covering a foam quality range from 70 to 90%. At steady state, liquid saturations remain constant near 35% independent of gas velocity. Moreover, measured foam-flow resistances practically do not vary with gas velocity over the studies range. Foam textures, however, do vary dramatically. For example, injected fine bubbles near 80 μm in diameter exit the sandstone with sizes around 300 μm. Powerful coalescence forces are the origin of this coarsening. Effluent bubble sizes increase slightly with increasing gas velocity, but are independent of the injected size. A simple one-dimensional foam population-balance model is outlined to quantify the observed flow and texture behavior. At steady state, generation and coalescence mechanisms alter the foam texture over distances of less than about a centimeter. 31 refs., 12 figs., 1 tab.

2110 (ETDE-mf–0718080) **Analysis, development and investigations into phase behaviour of surfactant systems for de-oiling high-salinitiy reservoirs with reference to the Bockstedt field of Wintershall AG. Final report.** Krusche, G.; Greif, N.; Lessner, E. BASF A.G., Ludwigshafen am Rhein (Germany, F.R.); Wintershall A.G. Erdoelwerke, Barnstorf (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Jan 1988. 89p. (In German). BMFT 03E6123 B/C/9. Order Number DE90718080. Available from NTIS (US Sales Only), PC A05/MF A01.

To achieve close cooperation between surfactant analysis, surfactant synthesis and phase investigations, R and D-projects 03E-6123 B and 03E-6123 C were run as team projects by BASF and Wintershall. The development of new analytical methods enabled non-ionic and ionic surfactants in oil/water matrices to be quantitatively determined. Further, the manufacture of the surfactants, including byproducts, was analytically monitored. The task of sufactant synthesis was to optimize the individual reaction stages and to minimize the occurrence of byproducts. Where neccessary, surfactant structures were varied and commercially unavailable surfactants made accessible. The phase behaviour of non-ionic and ionic surfactants was substantially clarified with the aid of systematic phase investigations on ternary water/oil/surfactant systems. A number of suitable surfactant combinations was developed for the reservoir conditions in the Bockstedt field. (orig.) With 1 tab., 57 figs.

2111 (LBL–27729) **The influence of texture on steady foam flow in Berea sandstone.** Ettinger, R.A.; Radke, C.J. Lawrence Berkeley Lab., CA (USA). Jun 1989. 50p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC03-76SF00098. (CONF-891049–3: Society of Petroleum Engineers annual technical conference and exhibition, San Antonio, TX (USA), 8-11 Oct 1989). Order Number DE90003112. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An understanding of texture, or bubble-size, evolution is paramount for modeling foam flow in porous media in that fine textures may impart large flow resistances. Bubble size, in turn, is determined by complicated lamellae creation and decay processes. We study, for the first time, the quantitative role of bubble size in the steady flow of strong foam through a 0.8-μm^2 Berea sandstone. Inlet and outlet textures are determined from photomicrographs taken of bubbles flowing through specially designed visual cells. Concurrent measurements of pressure profiles and liquid saturation profiles by microwave attenuation are acquired for gas velocities ranging from 1 to 3 m/day and covering a foam quality range from 70 to 90%. 31 refs., 12 figs.

2112 (NIPER–417) **Use of amine oxide surfactants for chemical flooding EOR [enhanced oil recovery].** Olsen, D.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Nov 1989. 37p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE89000773. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The use of amine oxides with and without alcohols as cosolvents, and in combination with other surfactants as mixed micellar formulations for enhanced oil recovery by surfactant flooding was investigated. Amine oxides are a salt-tolerant class of surfactants that produce low interfacial tension and can develop viscosity without the addition of polymers. These salt-tolerant formulations generate three-phase regions with hydrocarbons over a broad salinity range, develop moderate solubilization, and produce low interfacial tensions, however oil recovery from amine oxide-alcohol phase behavior optimized formulations was directly dependent upon the quantity of surfactant injected. The large pore volume and high concentration of surfactant required prohibits their economic use as the primary surfactant in chemical flooding EOR. Dimethylalkylamine oxides are useful as cosurfactants and viscosifiers in formulations with other surfactants for chemical flooding EOR but the use of ethoxylated and propoxylated amine oxides should be avoided due to the decomposition of these amine oxides under reservoir conditions. Phase behavior, phase inversion temperatures, and viscosity scans have been correlated with surfactant structures to provide a guide for amine oxide applications in chemical flooding. 36 refs., 5 figs., 6 tabs.

2113 (NIPER–438) **Ambient and high-temperature calorimetry of commercial surfactants: Project BE4A, Milestone 8, FY89 annual research plan.** Noll, L.A. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Sep 1989. 53p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract FC22-83FE60149. Order Number DE90002802. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Knowledge of the critical micelle concentration (CMC) is required for the effective use of surfactants for steamflooding, surfactant enhanced oil recovery, and process applications. The CMC's and solution behavior of commercial surfactants as a function of temperature were studied by dilution calorimetry. The surfactants selected were Chevron's Chaser SD1000, a good foamer; Shell's Enordet

AOS 1416, an intermediate foamer; and Diamond-Shamrock's Sellogen WL, a poor foamer. Although Sellogen is not intended to be used as a steam additive, it was included to emphasize differences between good and poor foamers. In addition to these surfactants, two carboxymethylated ethoxylated surfactants were used: Huels' B498 and Sandox's Sandopan MA-18. Finally, a mixture of Enordet and MA-18 was tested as an example of mixed surfactant types. 9 refs., 12 figs., 36 tabs.

2114 (NIPER–443) **Selection of an effective biocide and toxicity evaluation for a specific MEOR [microbial enhanced oil recovery] microbial formulation.** Chase, K.L.; Bryant, R.S.; Bertus, K.M.; Stepp, A.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Sep 1989. 18p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE90002573. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The two major environmental impacts associated with microbial enhanced oil recovery (MEOR) are possible contamination of surface and groundwater and contamination of agricultural land. Other potential environmental problems associated with MEOR processes include changes in indigenous microflora in reservoirs caused by injection of nonindigenous microorganisms and nutrient, or the possibility of injected microorganisms mutating and producing undesirable compounds under reservoir conditions. A specific MEOR microbial formulation, NIPER 1 and 6, was first tested for pathogenicity and mutagenicity of its metabolic products. Pathogenicity testing included both oral ingestion and intraperitoneal injection of the NIPER 1 and 6 formulation using mice. The Ames test was used to determine any mutagenic tendencies of filtered NIPER 1 and 6 metabolic products. Although the MEOR formulation tested negative for both pathogenicity and mutagenicity, biocide tests were conducted to select an effective biocide in the event of a spill or environmental hazard when using this formulation in the field. An aqueous solution of 370 ppM formaldehyde was the most effective biocide for eradicating the microbial formulation. For reservoir injection, sodium hypochlorite at an aqueous concentration of 5000 ppM appears to control growth of the microbial formulation and is less hazardous to the environment. 13 refs., 4 figs., 6 tabs.

2115 **Predicting horizontal/slanted well production by mathematical modeling.** Chang, M.M. (National Institute for Petroleum and Energy Research (US)); Tomutsa, L.; Tham, M.K. vp of SPE joint Rocky Mountain regional/low permeability reservoirs symposium and exhibition. Society of Petroleum Engineers, Richardson, TX (1988). (CONF-890354–: SPE joint Rocky Mountain regional meeting and low permeability reservoir symposium, Denver, CO (USA), 6-8 Mar 1989).

Technical Paper SPE 18854.

This paper presents a horizontal and slanted well model developed and incorporated into BOAST, a black oil simulator, to predict the potential production rates for such wells. The slanted/horizontal well model can be used to calculate the productivity index, based on the length and location of the wellbore within the block, for each reservoir grid block penetrated by the slanted/horizontal wellbore. Production rates from vertical wells, horizontal wells, and slanted wells of variable well lengths in a field of 40-acre well spacing are compared.

2116 **A correlation for interference testing with wellbore-storage and skin effects.** Ogbe, D.O. (Alaska Univ., Fairbanks, AK (USA)); Brigham, W.E. *SPE (Society of Petroleum Engineers) Formation Evaluation (USA),* 4(3): 391-396 (Sep 1989).

In this paper a new correlation and set of pressure-response and pressure-derivative type curves are presented for interference test analysis. The influence of wellbore storage and skin effects at active and observation wells on interference pressure response is examined. In the case of wellbore storage and skin in one well, the correlating parameter $[C_De^{2s}]C_D/r_D^2$ is used to combine wellbore storage and skin variables in a way that makes it possible to display, on a single type curve, all interference test data that would ordinarily require a number of type curves for various combinations of C_D/r^2_D and C_De^{2s}. The product of the correlating parameter is used when wellbore storage and skin effects are active at both wells. The difference in the shapes of the single-well storage type curves compared to the two-well storage case at early times can be used as a diagnostic features in interference testing.

2117 **Altered-stress fracturing.** Warpinski, N.R. (Sandia National Labs., Albuquerque, NM (USA)); Branagan, P.T. *Journal of Petroleum Technology (USA),* 41(9): 990-996 (Sep 1989). DOE Contract AC04-76DP00789.

This paper describes altered-stress fracturing, a concept whereby a hydraulic fracture in one well is reoriented by another hydraulic fracture in a nearby location. A field test was conducted in which stress changes of 250 to 300 psi [1.7 to 2.1 MPa] were measured in an offset well 120 ft [37 m] alway during relatively small minifractures in a production well. Results show that altered-stress fracturing is possible at this site and others.

0204 Processing

Refer also to citation(s) 2022, 2025, 2027, 2049, 2269

2118 (DOE/CH/10093–57) **Membrane separation processes for liquid hydrocarbons and gases in the petrochemical industry: A technical case study.** Solar Energy Research Inst., Golden, CO (USA); Energetics, Inc., Columbia, MD (USA). Sep 1989. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093;AC01-87CE40762. Order Number DE89009464. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

OIP and Allied Signal Corporation have completed a joint project exploring new applications of membrane separation technology for the petrochemical and related industries. These applications have the potential for major energy savings compared to more traditional distillation and chemical absorption processes. This technical case study provides an overview of the DOE-Allied Signal membrane development project. It highlights the field testing of modified cellulose acetate membrane systems for acid gas removal at two commercial natural gas plants. The document is aimed at making field test and data analysis results available to other researchers and private industry in a timely manner. This case study discusses project status; summarizes field testing efforts; and reviews potential technology impacts in terms of applications, energy savings, and preliminary economics.

0205 Products and By-products

Refer also to citation(s) 2124, 2270, 2781, 2980

2119 (AD-A–210188/9/XAB) **Properties of F-34 (JP-8) fuel for 1988. Summary report, January-December 1988.** Martel, C.R. Wright Research and Development Center, Wright-Patterson AFB, OH (USA). Apr 1989. 27p. (WRDC-TR–89-2021). Available from NTIS, PC A03/MF A01.

This report summarizes the properties of 95 F-34 fuels delivered to U.S. military installations during calendar year 1988. Most of the fuel was obtained from refineries in Germany, Spain, Sicily and Greece, with one shipment obtained from Bahrain and seven shipments from Venezuela. F-34 destinations included the Central European Pipeline (via terminals in Germany and France), the United Kingdom Pipeline, the Azores, Spain, Italy, Korea and the United States. All of the F-34 fuels met Specification MIL-T-83133B requirements except for Particulate Matter (5 of the 95 fuels slightly exceeded the limit). Most fuel properties were well within specification limits. Two controversial specification limits are the 0.002 wt % limit on mercaptan sulfur (commercial jet fuel specifications allow up to 0.003 wt %) and the filtration-time limit. None of the fuels exceeded 0.001 weight percent mercaptan sulfur. Also, all fuels met the filtration time limit, although several fuels were at the specification limit of 15 minutes.

2120 (AD-A–210195/4/XAB) **High-energy-density solid and liquid hydrocarbon fuels. Final report, July 1987-December 1988.** Marchand, A.P. Geo-Centers, Inc., Newton Upper Falls, MA (USA). Feb 1989. 37p. Available from NTIS, PC A03/MF A01.

The development of new high-energy hydrocarbon fuels for use in air-breathing missiles has been the objective of a number of investigations which have received support during the past decade through programs sponsored by the Air Force Systems Command

and/or the Naval Air Systems Command. The key characteristics which must be met by potential cruise missile fuels have been described by Burdette and coworkers. A primary requirement in this regard is that candidate fuels must possess high net volumetric heat of combustion (preferably greater than 160,000 BTU/gallon). In order to meet the primary requirement of high net volumetric heat of combustion, hydrocarbon systems have been sought which maximize the ratio of carbon-atom to hydrogen-atom content have been sought that maximize the ratio n/m.(JES)

2121 (AD-A–210547/6/XAB) **Wide-range fuel flowmeter. Phase 2. Final report, 4 June 1986-3 February 1988.** Seiler, W. Waugh Controls Corp., Chatsworth, CA (USA). Jul 1989. 120p. Available from NTIS, PC A06/MF A01.

The Wide-Range Fuel Flowmeter (WRFF) development program proved the viability of the recirculation method of wide-range flow measurement over a 140 to 1 or greater range with a 1% or better measurement uncertainty. The objectives were to: (1) Reduce the size of the flowmeter and electronic conditioner and provide a more functional and economically producible system; (2) Replace the recirculating pump with a smaller, more-reliable unit and assure that all components in contact with the fluid are compatible with jet fuels; (3) Provide means to disable recirculating flow when operating at high flow rates; and (4) Evaluate the performance of an air-driven pump for possible use in hazardous atmospheres. The meter was redesigned to greatly reduce its size and weight; large and expensive manifolds were eliminated, and wherever possible, commercially available fittings were used. Inwardly pointing tubes were incorporated to inject and retrieve the recirculating flow, reducing recirculation flow variation and related recirculation flow errors. The electronic conditioner was repackaged in a standard 3-1/2-by 19-in. rack mount. An auto-zero feature was created and incorporated in the electronic conditioner, greatly simplifying and accelerating the zeroing process. Testing was conducted to verify rangeability, transient response, long-term stability without re-zeroing, meter performance without recirculation, and performance using an air-driven pump.

2122 (AD-A–211055/9/XAB) **US Marine 3rd Tank Battalion lubrication evaluation under hot ambient temperatures at Twenty-Nine Palms, California. Interim report, April-September 1988.** Butler, W.E.; Owens, E.C.; Frame, E.A.; Bowen, T.C. Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility. Sep 1988. 43p. (BFLRF–251). Available from NTIS, PC A03/MF A01.

Military Specification MIL-L-2104D, Lubricating Oil, Internal Combustion Engines, Tactical Service, was released 1 April 1983. This specification included a multiviscosity OE/HDO-15/40 oil and eliminated a previously authorized OE/HDO-50 oil. The manufacturer of the AVDS-1790 series engines used in M60 battle tanks and M88 tank retrievers raised raised concerns about warranty coverage. The U.S. Marine Corps indicated that the use of the authorized 15W-40 grade oil did not offer sufficient lubrication for the engines and also resulted in M60 final drive leaks. As a result of these concerns, the U.S. Army Belvoir Research, Development and Engineering Center (Belvoir RDE Center) authorized an oil comparison test that, by agreement with the U.S. Marine Corps, would be conducted at the U.S. Marine Corps Air-Ground Combat Center (USMCAGCC) at Twenty-Nine Palms, CA using the U.S. Marine 3rd Tank Battalion (3DTKBn). The test vehicles of A Company, 3DTKBn were charged with regular issue 50-grade oil in the engine, 10-grade oil in the transmission, and 50-grade oil in the M60 final drives. B Company's test vehicles were charged with 15W-40 grade oil in the engines, transmissions, and M60 final drives. C Company's test vehicles were charged with 40-grade oil in the engines, 10-grade oil in the transmissions, and 50-grade oil in the final drives. Results from this 4-month test indicated no discernible differences in engine or transmission operating temperatures, engine oil pressures, or M60 final drive leaks.

0206 Health and Safety

2123 (INIS-BR–1718) **Oil wells and gas wells: aspects of radiological safety.** Soares, S.M.V.O. Instituto Brasileiro do Petroleo, Rio de Janeiro, RJ (Brazil). 1987. 12p. (In Portuguese). (CONF-8705395–: 5. Seminar on Industrial Safety, Fortaleza (Brazil), 26-29 May 1987). Order Number DE90608333. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The objective of the present work is to present and analyse the main radiological protection problems associated with non destructive inspections of oil wells, with the view of minimizing the dose to members of the public living in nearby urban zones. Problems related to the surveillance of such activities and the need for well formulated procedures are also discussed based on specific Brasilian regulations. Finally, some examples of radiological accidents that have occured in urban zones are described including the methodology employed for the rescue of Iridium-192 sources and for the estimate of radiation doses for workers and general public. (author).

0207 Marketing and Economics

Refer also to citation(s) 2085

2124 (CEC–90003094) **Quarterly oil report: First quarter, 1989.** California Energy Resources Conservation and Development Commission, Sacramento, CA (USA). Jun 1989. 52p. Sponsored by California Energy Commission. (P–300-89-016). Available from OSTI; California Energy Commission, Publications Unit, 1516 Ninth Street, MS-13, Sacramento, CA 95814.

This report contains compiled data on petroleum fuels market activity, price trends, refinery activities, petroleum production, and petroleum company financial statements for the state of California. (CBS)

2125 (DOE/EIA–0380(89/08)) **Petroleum marketing monthly.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. Aug 1989. 201p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002807. Available from NTIS, PC A09/MF A01 - GPO - OSTI; GPO Dep.

The Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analyst, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented.

2126 (ETDE-mf–0718167, pp. 93-112) **The present-day situation of the mineral oil industry.** Belka, H.G. (Deilmann (C.) AG, Bentheim (Germany, F.R.). Abt. Strategische Planung). Technische Univ. Berlin (Germany, F.R.). 1987. (In German). In *Festive colloquium to celebrate the 70th anniversary of Prof. em. o. Dr.-Ing. Friedrich Adler. Berlin, October 17, 1986.* Order Number DE90718167. Available from NTIS (US Sales Only), PC A06/MF A01.

Based on the extreme decline of crude oil prices, the author demonstrates the effects of crude-oil price development on the earning situation and on the economic situation of the German oil producing industry. The author also comments on the perspectives for the production of crude oil in Germany in the future. (MOS).

0208 Waste Management

2127 (PB–89-224810/XAB) **Guide to oil waste-management alternatives for used oil, oily waste water, oily sludge, and other wastes resulting from the use of oil products. Final report.** Energy and Environmental Research Corp., Irvine, CA (USA). Apr 1988. 223p. Available from NTIS, PC A10/MF A01.

See also PB–89-224802.

This report presents the results of a study of oil waste-management alternatives. The study includes regulations, established and emerging technologies, current practices, economics, and environmental impacts of oil waste management. The report focuses on methods of improving oil-waste recyclability and phasing out land disposal. The report includes recommendations for industrial oil-waste generators. It is the companion volume to 'Oil Waste Management Alternatives Symposia – Conference Proceedings'.

0209 Environmental Aspects

2128 (PB–89-219430/XAB) **Effects of wind and Gulf Stream events on the currents off the coast of North Carolina as it relates to oil-spill risk potential.** Vukovich, F.M.; Crissman, B.W.; Pietrafesa, L.J.; Janowitz, G.S.; Weisberg, R.H. Minerals Management Service, Herndon, VA (USA). Aug 1984. 70p. Available from NTIS, PC A04/MF A01.

The purpose of this study was to determine the potential effects of wind-induced currents and Gulf Stream events on the current regime off the North Carolina coast.

2129 (PB–89-220701/XAB) **Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 1. Final executive summary.** Battelle New England Marine Research Lab., Duxbury, MA (USA). 30 Apr 1985. 47p. Available from NTIS, PC A03/MF A01.

See also Volume 2, PB–89-220719; Also available in set of 3 reports PC E99, PB–89-220693.

A 10-month study by the Research Institute of the Gulf of Maine was conducted to gather and inventory the existing environmental socio-economic data of the coastal zone and adjacent outer continental shelf from Sandy Hook, New Jersey to Bay of Fundy. These data were based on the requirements for impact assessments prior to leasing offshore areas for oil, gas, and mineral exploration and production. The marine boundaries were Hudson Canyon, the 200 meter contour, and the Canadian international line; shoreward, the limit of salt intrusion was the boundary while some 38 counties were inventoried for socio-economic data. Over 300 persons were contacted or interviewed, 3800 documents reviewed for data by about 40 scientists and consultants. The major topics inventoried and presented in the report are environmental, systems ecology by habitat, unique and endangered environments, environmental quality, and socio-economics.

2130 (PB–89-220719/XAB) **Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2.** Maciolek-Blake, N.; Grassle, J.F.; Neff, J.M. Battelle New England Marine Research Lab., Duxbury, MA (USA). 15 Apr 1985. 357p. Available from NTIS, PC A16/MF A01.

See also Volume 1, PB–89-220701 and Volume 3, PB–89-220727. Errata sheet inserted; Also available in set of 3 reports PC E99, PB–89-220693.

Concerns about the potential effects of oil- and gas-exploration activities on Georges Bank led to the initiation of a monitoring program in July 1981. The program included sampling of the benthic communities near, upcurrent, and downcurrent of the drilling rigs, analysis of bottom photographs for epifauna and microtopography, trawl collections, total organic carbon and sediment grain size analysis. Additional aspects of the program included a detailed life history analysis of 23 dominant species, and a study which linked fish feeding with benthic production. No biological impacts that could be attributed to drilling activities were detected at any station.

2131 (PB–89-220727/XAB) **Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices.** Maciolek-Blake, N.; Grassle, J.F.; Neff, J.M. Battelle New England Marine Research Lab., Duxbury, MA (USA). 15 Apr 1985. 254p. Available from NTIS, PC A12/MF A01.

See also Volume 2, PB–89-220719; Also available in set of 3 reports PC E99, PB–89-220693.

Concerns about the potential effects of oil- and gas-exploration activities on Georges Bank led to the initiation of a monitoring program in July 1981. The program included sampling of the benthic communities near, upcurrent, and downcurrent of the drilling rigs, analysis of bottom photographs for epifauna and microtopography, trawl collections, total organic carbon and sediment grain size analysis. Additional aspects of the program included a detailed life history analysis of 23 dominant species, and a study which linked fish feeding with benthic production. No biological impacts that could be attributed to drilling activities were detected at any station.

2132 (PB–89-222475/XAB) **Removal of oil from oil-water mixtures using selective oil filtration. Masters thesis.** Magdich, P.; Semmens, M. Minnesota Univ., Minneapolis, MN (USA). Dept. of Civil and Mineral Engineering. Jun 1988. 183p. Available from NTIS, PC A09/MF A01.

This project studied the selective oil filtration (sof) process as an alternative method for removing oil from oily waste waters or other oil-containing wastes. The sof is similar to ultrafiltration in that microporous membranes are used. Unlike in ultrafiltration, however, oil rather than water is selectively removed by applying a pressure across the membrane. The results show that the sof process will remove free, mechanically dispersed and chemically emulsified oil from oil-water mixtures. Sof did not work for the removal of oil-wet solids, and, prior to filtration, the suspended solids must be removed to prevent membrane fouling.

2133 (PB–89-871974/XAB) **Oil-spill removal techniques and equipment. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 75p. Available from NTISPC N01/MF N01.

Supersedes PB–86-871589.

This bibliography contains citations concerning equipment and techniques for the control, dispersion, cleanup, and disposal of oil spills. Topics include chemical dispersants, booms, and mechanical skimmers. Harbors, estuaries, shorelines and the resulting impact on water birds and marine life are emphasized. (This updated bibliography contains 171 citations, 20 of which are new entries to the previous edition.)

0220 Transport, Pipelines, and Handling

2134 (AD-A–210909/8/XAB) **Lubricated pipelining: Stability of core-annular flow.** Joseph, D.D. Minnesota Univ., Minneapolis, MN (USA). Dept. of Aerospace Engineering and Mechanics. 1989. 34p. Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of Fluid Mechanics, Vol. 201, 323-356(1989).

There is a strong tendency for two fluids to arrange themselves so that the low-velocity constituent is in the region of high shear. This gives rise to a kind of gift of nature in which the lubricated flows are stable, and it opens up very interesting possibilities for technological applications in which one fluid is used to lubricate another. We can imagine that it may be possible to introduce a beneficial effect in any flow of very viscous liquid important in applications by introducing small amounts of lubricating fluid. Nature's gift is evidently such that the lubricating fluid will migrate to the right places so as to do the desired job. There are significant reserves of heavy viscous crude oils in the United States, Canada, Venezuela, and Europe. Heavy crudes may have viscosities of 1000 P at room temperature. These viscous crudes cannot be transported by the usual pipeline methods. It is customary to reduce the viscosity of the oil either through the addition of a hydrocarbon diluent or through the installation of heating equipment at short intervals along the pipeline.

0230 Properties

Refer also to citation(s) 2800

2135 (STEV–1989-R5) **Petroleum fuels. Development of quality from 1980 and on.** Bergholm, A. Statens Energiverk, Stockholm (Sweden). Feb 1989. 88p. (In Swedish). Order Number DE90719392. Available from NTIS (US Sales Only), PC A05/MF A01.

The development of the fuel market in Europe leads to a decreased share of heavy-oils and an increased share of light products, particularly diesel oil. In any case, avaliable crude oils will not be. There is rather a weak tendency towards heavier crude oils with an increased share of residual oil. Both these tendencies make the refineries pass on to technologies producing a considerably increased yield of lighter products. The easiest way to increase the light products yield is thermal or catalytic cracking. A considerable expansion of the cracking capacity has already taken place and continues. There is a risk for those alterations in the refinery stage to result in a deteriorated fuel quality bringing about negative consequences particularly for the environment. However, available analyses indicates that the Swedish quality changes have been very marginal up to now.(With 10 illustrations, 11 tables and 35 references).

03 NATURAL GAS

2136 (PB–89-232599/XAB) **Review of physical science research, 1979-1988.** Gas Research Inst., Chicago, IL (USA). May 1989. 109p. (GRI–89/0150). Available from NTIS, PC A06/MF A01.

This review of Gas Research Institute's (GRI's) physical sciences research highlights the results of 10 years of research in chemistry, physics and engineering, combustion, and biotechnology. Reviews of 43 program elements include actual research costs and documented coordinated funding; reasons for the research; research goals; technical approach; key results; and plans for further research.

2137 (PB–89-235949/XAB) **Continuation of gas technology, basic research, and education. Final report, August 15, 1985-August 15, 1988.** Arastoopour, H.; Chen, S.T.; Davuluri, R.P.; LeGallo, Y.; Teske, E. Illinois Inst. of Tech., Chicago, IL (USA). Jan 1989. 397p. Available from NTIS, PC A17/MF A01.

The program covers aspects of basic research and education in gas engineering.

0301 Reserves

2138 (DOE/MC/23140–2695) **Multizone completion opportunities in the Appalachian basin: Final report.** Koziar, G. Columbia Gas System Service Corp., Columbus, OH (USA). Mar 1989. 107p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-86MC23140. Order Number DE89000979. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report identifies areas of favorable Devonian shale gas potential beyond historically productive shale regions of the Appalachian basin in West Virginia. Geologic, reservoir and production data were employed to establish parametric correlations and trends. In particular, formation stress ratio, permeability-thickness product, gas production and modified productivity index terms were used to determine relationships and define Devonian shale gas potential. 9 refs., 47 figs., 4 tabs.

2139 (NEI-DK–219) **Report on the Ministry of Energy's statement regarding subsection 2 of section 12 of act number 293 of 10th June 1981, on the utilization of Denmark's subterranean committee on 26th October 1988.** Det Energipolitiske Udvalgs beretning, 2. Energipolitisk Udvalg, Copenhagen (Denmark). 6 Dec 1988. 12p. (In Danish). Order Number DE90719068. Available from NTIS (US Sales Only), PC A03/MF A01.

Det Energipolitiske Udvalgs beretning, 2.

The report on the Ministry of Energy's statement regarding subsection 2 of section 12 of act no. 293 of 10th June 1981 on the utilization of Denmark's subterranean areas, delivered to the Energy Policy Committee on 26th October 1988, concerns the government's plans for giving permission for investigations of the resource potentials and the recovery of hydrocarbons in Danish underground areas to various companies. Economic and environmental aspects are dealth with and the opinions of some Danish political parties on the subject are described. Conditions for granting similiar concessions in Norway, England, Ireland and Holland are compared with those found in Denmark, and the subject of Danish government subsidies granted to research and training activities in this field is elaborated. A list of research projects is given. Other relevant questions, and the answers given to them by the Danis Ministry of Energy, appear in the supplements. (AB).

0302 Geology and Exploration

Refer also to citation(s) 2105, 2106, 2142

2140 Analysis of natural fractures observed by borehole video camera in a horizontal well. Overbey, W.K. (BDM Corp. (US)); Yost, L.E.; Yost, A.B. vp of SPE joint Rocky Mountain regional/low permeability reservoirs symposium and exhibition. Society of Petroleum Engineers, Richardson, TX (1988). (CONF-890354–: SPE joint Rocky Mountain regional meeting and low permeability reservoir symposium, Denver, CO (USA), 6-8 Mar 1989).

Technical Paper SPE 17760.

A video camera survey was used to examine 2217 feet of horizontal wellbore. The air-drilled hole was clean and generally free of debris. More than 200 curvalinear features were noted in the wellbore which were interpreted to be natural fractures. A method of orienting the features observed was developed and tested by building a replica of a section of a wellbore and examining features with known inclination and orientation. Special video enhancement and playback equipment was used to examine the video tape and orient features in the wellbore. This method of analysis provides information useful in designing completions and stimulations in low-pressure reservoirs.

2141 Multi-mechanistic approach to the reservoir analysis of tight blanket sands. Bezilla, M. (Pennsylvania State Univ. (US)); Ertekin, T.; Adewumi, M.A.; Frohne, K.H. vp of SPE joint Rocky Mountain regional/low permeability reservoirs symposium and exhibition. Society of Petroleum Engineers, Richardson, TX (1988). (CONF-890354–: SPE joint Rocky Mountain regional meeting and low permeability reservoir symposium, Denver, CO (USA), 6-8 Mar 1989).

Technical Paper SPE 18983.

Tight sand formations, because of their peculiar characteristics, do not conform to the well established behavioral patterns normally associated with conventional natural gas reservoirs. It is believed that the major bottleneck in the development of these resources is the lack of understanding of the fluid dynamics in these formations. It is therefore imperative to evolve a good model based on a fundamental understanding of the rather unique physics of flow in this media. This physics calls for the use of dual-porosity, multi-mechanistic approach for the description of the transport of natural gas in these formations. Such a model is presented in this paper. Both synthetic and actual field examples are used to illustrate the predictive capability of the model. Results show that the conventional single-mechanistic approach tends to under-predict recovery. They also demonstrate that the dual-mechanistic approach is of the essence.

0303 Drilling, Production, and Processing

2142 (DOE/METC–89/6103) **Proceedings of the natural gas R&D contractors review meeting.** Komar, C.A.; Malone, R.D.; Byrer, C.W. USDOE Morgantown Energy Technology Center, WV (USA). Apr 1989. 476p. Sponsored by U.S. DOE Fossil Energy. (CONF-890492–: Natural gas research and development, Morgantown, WV (USA), 18-19 Apr 1989). Order Number DE89011683. Available from NTIS, PC A20/MF A01 - OSTI; GPO Dep.

The purpose of this meeting is to present key results of research in the DOE sponsored Natural Gas Program and to simultaneously provide real time technology transfer to the interested public. Over the past year, the DOE Natural Gas Research and Development program has been broadened in scope to include emphasis on the geoscience aspects that relate to eventual gas recovery, gas utilization, and research to recover additional gas from producing or previously produced fields. Major emphasis is on activities in Eastern Gas, Western Gas, Secondary Gas Recovery, Natural Gas to Liquids, Gas Hydrates, Deep Gas and Arctic/Offshore Research. Forty-one papers and fifteen poster presentations were given in seven formal sessions and one informal session: Two General Sessions, Natural Gas to Liquids, Eastern Gas, Western Gas, Hydrates/Deep Gas, and Arctic/Offshore. Individual projects are processed separately for the data bases.

2143 (PB–89-230627/XAB) **Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report.** Trofe, T.W.; Dalrymple, D.A.; Andrews, B.M. Radian Corp., Austin, TX (USA). Mar 1989. 133p. (DCN–88-218-043-43). Available from NTIS, PC A07/MF A01.

Liquid redox sulfur-recovery processes are of interest to the natural gas industry for treatment of sour reserves of conventional gas and of substitute natural gas (e.g., gas produced from gasifying coal). These processes offer high H_2S removal efficiency, one-step treatment, low energy requirements, the ability to handle low- and high-H_2S streams, and a regenerating catalyst. Sulfur is removed as gaseous H_2S and converted either to sulfur cake, a disposable waste, or to elemental sulfur which can be sold. Liquid redox processes have complex chemistries and can experience operating problems and less-than-design performance. This class of processes includes Hiperion, LO-CAT, Stretford, SulFerox, Sulfolin, and

Unisulf. The Gas Research Institute's liquid redox sulfur-recovery research program has initially focussed on gaining a better understanding of the Stretford process. Stretford is the oldest of the liquid redox processes and has over 100 plants in operation. The factors examined were feedgas CO_2 and H_2S concentrations, pH, temperature, ADA concentration, citrate, air rate, and reactor residence time. The second objective of the testing was to compare the performance of the 120-liter (32 gallon) GRI bench unit to the 500-gallon pilot unit at the Great Plains Gasification Plant (GPGP) near Beulah, North Dakota.

0306 Marketing and Economics

Refer also to citation(s) 2149

2144 (PB–89-235105/XAB) **Canadian natural gas: Export potential.** DataMetrics Ltd., Calgary, AB (Canada). Oct 1988. 13p. Available from NTIS, PC A03/MF A01.

See also PB–89-133821.

A study examined a range of possible exports based on a variety of assumptions concerning the price of oil and the size of the Canadian gas resource base. While results show that the available export volumes are sensitive to prices and resource estimates, the cumulative amount of Canadian gas that could be delivered to U.S. markets over the projection period (1986-2005) could be sufficient to satisfy the cumulative need for Canadian exports as projected by GRI.

2145 (PB–89-236590/XAB) **Commercial building research workshop. July 30-31, 1986.** ACEC Research and Management Foundation, Washington, DC (USA). Dec 1986. 38p. Available from NTIS, PC A03/MF A01.

GRI sponsored a workshop in Chicago on July 30-31, 1986 to review the commercial space conditioning and cogeneration research program at GRI. The objectives of the workshop were to solicit input to the R&D program and to expedite technology transfer by encouraging involvement in early review and field testing of prototypes. The workshop focused on the needs of three major market segments: hotels, large office buildings, and hospitals. The workshop agenda and a list of participants are presented along with findings and recommendations, and a discussion paper.

0308 Environmental Aspects

Refer also to citation(s) 2129, 2130, 2131

0309 Artificial Stimulation

2146 (PB–89-211031/XAB) **Rock matrix and fracture analysis of flow in western tight gas sands: 1988 annual report (Phase 4). Report for 30 December 1987-31 March 1989.** Morrow, N.R.; Buckley, J.S.; Cather, M.; Brower, K.R. New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center. May 1989. 93p. (PRRC–88-12). Available from NTIS, PC A05/MF A01.

See also PB–88-190665.

This report contains petrographic data and information about pore quality and distribution for thin sections taken from thirty MWX (Multiwell) cores recovered from three different wells and four depositional environments. Data were acquired using both transmitted and epifluorescent light microscopy. Trends are noted relating sample composition and pore quality to depositional environment; various petrophysical properties and features visible in thin section are related. Four samples from the marine zone have been added to advanced core analysis results. Effects of acetic acid treatment on cores containing mineralized fractures were investigated. Chemical treatment to determine mineralogic controls over flow properties continues, with HCl, NaOH, and oxalic acid being utilized as the reagents. Capillary pressure measurements made by centrifugation and mercury injection experiments are compared for six samples. Data relating gas permeability to electrical conductivity are reported for five samples; brine permeability-formation factor relationships are reported for one of these samples.

2147 **Inducing multiple hydraulic fractures from a horizontal wellbore.** Overbey, W.K. (BDM Engineering Services Corp. (US)); Yost, A.B.; Wilkins, D.A. vp of SPE joint Rocky Mountain regional/low permeability reservoirs symposium and exhibition. Society of Petroleum Engineers, Richardson, TX (1988). (CONF-890354–: SPE joint Rocky Mountain regional meeting and low permeability reservoir symposium, Denver, CO (USA), 6-8 Mar 1989).

Technical Paper SPE 18249.

A series of stimulations were designed to open and propagate natural fractures known to exist along a 2000 foot horizontal well in Wayne County, West Virginia. The stimulations were also designed to induce fractures in the formation as well as propagate the natural fractures by manipulating pressure and injection rates. A number radioactive tracers were used to determine where fractures were opened and propagated at different injection rates. The tracers were found in fractures in zones other than the one pumped into, a fact considered prima facie evidence that natural fractures with two or more orientations had been opened and propagated. Pressure testing and gas sampling of the isolated zones confirm that fracture communication was accomplished along nearly 1000 feet of borehole by stimulation of one 400 foot long section. A technique for including multiple hydraulic fractures with multiple orientations is demonstrated.

2148 **Understanding the effect of natural fractures on the hydrofracture stimulation of gas reservoirs.** Heuze, F.E. (Lawrence Livermore National Lab. (US)); Shaffer, R.J.; Blair, S.C.; Thorpe, R.K. vp of SPE joint Rocky Mountain regional/low permeability reservoirs symposium and exhibition. Society of Petroleum Engineers, Richardson, TX (1988). DOE Contract W-7405-ENG-48. (CONF-890354–: SPE joint Rocky Mountain regional meeting and low permeability reservoir symposium, Denver, CO (USA), 6-8 Mar 1989).

Technical Paper SPE.

This paper describes a finite element model for propagation of discrete fractures which has been coupled to an implicit time-dependent fluid flow capability to be used as a predictive tool for hydraulic fracturing through sandstones lenses, as found in the Western Tight Gas Sands. Validation of the model is obtained by simulating controlled physical experiments. The authors' numerical model, FEFFLAP, was used to replicate the extension of a single-wing crack, driven through gypsum cement into a sandstone lens. Pressure-time records from the model and the experiments are compared.

0320 Transport, Pipelines, and Handling

Refer also to citation(s) 2715

2149 (DOE/EIA–0145(88)) **Statistics of interstate natural gas pipeline companies, 1988.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 6 Nov 1989. 231p. Sponsored by U.S. DOE Management & Administration. Order Number DE90003070. Available from NTIS, PC A11/MF A01 - GPO - OSTI; GPO Dep.

The Statistics of Interstate Natural Gas Pipeline Companies 1988, presents financial and operating information of all major interstate natural gas pipeline companies that operated in the United States during 1988. This report is used by the Federal Energy Regulatory Commission (FERC), state utility commissions, other government agencies, and the general public. The information is taken from FERC Form 2, "Annual Report of Major Natural Gas Companies," as filed with the Federal Energy Regulatory Commission.

2150 (PB–89-232649/XAB) **Development of short-term tests for evaluating plastic gas-piping materials. Annual report, January-December 1984.** Cassady, M.; Hulbert, L.; Krishnaswamy, P.; Lustiger, A.; Uralil, F. Battelle Columbus Div., OH (USA). Jan 1986. 36p. Available from NTIS, PC A03/MF A01.

The Slow Crack Growth test was demonstrated by gas utilities to be one of the useful methods for studying the fracture resistance of polyethylene pipe. In the same way, the Constant Tensile Load test was shown to be an accelerated method for quality assurance testing for lot-to-lot variation in pipe received by gas utilities. The Rapid Crack Propagation study resulted in a design procedure that allows

gas utilities to predict conditions in gas-piping systems that will result in arrest of rapidly propagating cracks. Reports will be published on each topic and on the set of field failures prepared to date.

0330 Properties

2151 (PB–89-222608/XAB) **Tables for the thermophysical properties of methane. Technical note.** Friend, D.G.; Ely, J.F.; Ingham, H. National Inst. of Standards and Technology, Boulder, CO (USA). Thermophysics Div. Apr 1989. 489p. (NIST/TN–1325). Available from NTIS, PC A21/MF A01.

Also available from Supt. of Docs. as SN003-003-02947-5.

The thermophysical properties of methane are tabulated for a large range of fluid states based on recently formulated correlations. For the thermodynamic properties, temperatures from 91 to 600 K at pressures less than 100 MPa are included. For the viscosity, the corresponding range is 91 - 400 K with pressures to 55 MPa, while for the thermal conductivity the range is 91 - 600 K with pressures to 100 MPa. In addition to the tables of properties, algebraic expressions and associated tables of coefficients are given to allow additional property calculations. Tables of comparisons between experimental property determinations and the correlations are also given both for primary data used in the formulation of the correlations and for additional data. A listing of a FORTRAN program for the evaluation of methane thermophysical properties using the Schmidt-Wagner equation of state is included.

0340 Combustion

Refer also to citation(s) 2417, 2428, 2663, 2933, 3114

2152 (PB–89-230635/XAB) **Pulsating catalytic combustion of gaseous fuels. Final report, January 1987-September 1988.** Gal-Ed, R.; Daniel, B.R.; Zinn, B.T.; Gemmer, R.V. Georgia Inst. of Tech., Atlanta, GA (USA). School of Aerospace Engineering. Apr 1989. 128p. Available from NTIS, PC A07/MF A01.

The research determined the feasibility of using pulsations to improve the catalytic combustion of gaseous fuels. An experimental setup that could be operated under pulsating and steady-flow conditions was used to determine the dependence of the combustion efficiency of a catalytic combustor, consisting of one to four monolith catalyst sections, upon the reactive mixture temperature, velocity and air/fuel ratio, the type of fuel, the amplitude and frequency of pulsations, and the location of the catalytic combustor relative to the excited acoustic wave. Tests have shown that depending upon operating conditions and the fuel used, the excitation of pulsations can increase the combustion efficiency by up to 50%, modify the reaction rate distribution, change the stability of operation, and cause extinguishment. Significantly, it is shown that the effect of pulsations strongly depend upon the location of the catalyst sections relative to the excited acoustic-wave structure and the amplitude of pulsations.

2153 (PB–89-231583/XAB) **Laser probes of natural gas ignition chemistry. Annual report, January-December 1988.** Crosley, D.R.; Smith, G.P.; Golden, D.M. SRI International, Menlo Park, CA (USA). Jan 1989. 128p. (SRI-MP–89-038). Available from NTIS, PC A07/MF A01.

See also report for 1987, PB–88-212568.

This research, funded by the Physical Sciences Department of the Gas Research Institute, is aimed at developing and using laser-induced fluorescence of various hydrocarbon species as probes in natural gas combustion research and at developing an understanding of the mechanisms of ignition, catalytic combustion, and flame chemiluminescent emission of gas. In a collaborative effort with researchers from Yale University, LIF measurements were made of OH radicals and temperatures above a catalytically augmented gas-phase combustor at low pressure, showing the influence of catalytic surfaces at various mixing ratios. Laser-induced fluorescence diagnostics of C_2H_2, an important natural-gas ignition-chemistry intermediate, were developed in a low-pressure cell and in low pressure flames; both direct fluorescence excitation and the production of C_2 photofragment luminescence were investigated. Spectral-line overlaps between O atom and O_2 molecule excitations leading to photochemical interference were evaluated in flames. Unimolecular reaction-rate theory was applied to the study of the methyl and ethyl radical decomposition reactions, and several bimolecular metathesis and pressure-dependent bimolecular reactions were studied using transition-state theory. A methane flame chemistry code was implemented on the laboratory computer.

0350 Storage

2154 (PB–89-229652/XAB) **Dike insulation for LNG (liquefied natural gas) vapor mitigation. Topical report, September 1987-December 1988.** Atallah, S.; Peterlinz, M.E.; Shah, J.N. Risk and Industrial Safety Consultants, Inc., Des Plaines, IL (USA). 1 May 1989. 35p. Available from NTIS, PC A03/MF A01.

See also PB–89-229660.

Insulating materials may be applied to the surfaces of LNG impoundment areas in order to reduce the rate of heat transfer from the ground to any accidentally released LNG. This would result in a reduction of the extent of the flammable vapor cloud. Numerous studies have been carried out to develop dike insulating materials and to evaluate and compare their thermal and physical properties. This report summarizes the results of these studies. The authors conclude that an insulating polymer concrete (IPC) exhibits the most desirable thermal and mechanical characteristics. Design guidelines for the proper installation of IPC on LNG-impoundment surfaces and procedures for estimating total initial and annual maintenance costs are provided.

04 OIL SHALES AND TAR SANDS

0401 Reserves and Exploration

Refer also to citation(s) 2138

0404 Oil Production, Recovery, and Refining

2155 (DOE/LC/11066–2719-Vol.1) **Beneficiation-hydroretort processing of US oil shales, Volume 1: Final report.** Alabama Univ., University, AL (USA). Mineral Resources Inst.; Hycrude Corp., Chicago, IL (USA). Jan 1989. 150p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG21-85LC11066. Order Number DE89011684. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report has been divided into three volumes. Volume I describes the MRI beneficiation work. In addition, Volume I presents the results of joint beneficiation-hydroretorting studies and provides an economic analysis of the combined beneficiation-hydroretorting approach for processing Eastern oil shales. Volume II presents detailed results of hydroretorting tests made by MYCRUDE/IGT on raw and beneficiated oil shales prepared by MRI. Volume III comprises detailed engineered design drawings and supporting data developed by the Roberts and Schafer Company, Engineers and Contractors, Salt Lake City, Utah, in support of the capital and operating costs for a conceptual beneficiation plant processing in Alabama oil shale. 26 refs., 10 figs., 23 tabs.

2156 (DOE/LC/11075–2737) **Development of a reservoir simulation for thermal recovery of heavy oils/tar sands in the presence of gas hydrates: Final report.** Kamath, V.A.; Godbole, S.P. Alaska Univ., Fairbanks, AK (USA). Petroleum Development Lab. Oct 1988. 375p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG21-86LC11075. Order Number DE89011701. Available from NTIS, PC A17/MF A01 - OSTI.

The primary goal of this study was to determine the effect of presence of gas hydrates on the performance of thermal recovery methods such as steamflooding of heavy oils and tar sand bitumens. In order to achieve this goal, three models have been developed. The first model provides a fully implicit, r-z, finite difference simulation of hydrate dissociation for a reservoir containing only layered hydrates. The second model is a fully implicit, r-z, finite difference reservoir simulator which allows prediction of performance of a steamflood for a reservoir containing layered hydrates in conjunction with a zone of heavy oil/tar sands. For the third model, it is considered that the reservoir contains uniformly distributed packs of

gas hydrates within a heavy oil or tar sand zone. The report provides detailed equations, numerical solution approach for all the three models. A user friendly, interactive, menu-driven computer software for the fundamental hydrate dissociation model was developed and the program listing is provided. This model has been fully validated with other finite element type models. The results of the fundamental hydrate dissociation model are provided, and discussed. The other two models have also been computer coded. 24 refs., 19 figs., 3 tabs.

0410 Environmental Aspects

2157 (PB–89-226484/XAB) **Unocal Parachute Creek shale-oil Program. Environmental Monitoring Plan quarterly report, fourth quarter, 1988. Report for 1 October-31 December 1988.** Unocal Corp., Parachute, CO (USA). Energy Mining Div. 28 Feb 1989. 552p. (REPT–88-4Q). Available from NTIS, PC A24/MF A01.

See also PB–89-159164. Color illustrations reproduced in black and white.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The support agreement included development of an Environmental Monitoring Plan incorporating existing compliance monitoring and supplemental monitoring on water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1986-1993. Phase I of the project is to produce 10,000 barrels per day of syncrude from oil shale, using the Unishale 'B' process. The report contains results of industrial hygiene monitoring, a summary of supplemental sampling activities, and copies of compliance-monitoring reports. Details of an independent audit of the compliance programs are provided also. Approximately 30 pages of text and 519 pages of data sheets or reports are included.

2158 (PB–89-226492/XAB) **Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan quarterly report, first quarter, 1989. Report for 1 January 1989-31 March 1989.** Unocal Corp., Parachute, CO (USA). Energy Mining Div. 31 May 1989. 636p. (REPT–89-1Q). Available from NTIS, PC A99/MF A01.

See also PB–89-226484.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The support agreement included development of an Environmental Monitoring Plan incorporating existing compliance monitoring and supplemental monitoring on water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1986-1993. Phase I of the project is to produce 10,000 barrels per day of syncrude from oil shale, using the Unishale 'B' process. The compliance monitoring data, supplemental, environmental, and industrial-hygiene activities are summarized, and the results of the compliance program audit are also included. The main text is 23 pages; the ambient air monitoring reports, including computer data sheets, comprises the bulk of the report.

2159 (PB–89-226500/XAB) **Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan supplemental environmental data report. Volume 1. Trial trip sampling results. Report for 1 January 1988-31 March 1989.** Unocal Corp., Parachute, CO (USA). Energy Mining Div. 31 Jul 1989. 90p. Available from NTIS, PC A05/MF A01.

See also PB–89-226492.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The support agreement included development of an Environmental Monitoring Plan, incorporating existing compliance monitoring and supplemental monitoring on water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1986-1993. Phase I of the project is to produce 10,000 barrels per day of syncrude from oil shale, using the Unishale 'B' process. Results of monitoring 18 supplemental sites, including particulates, gases, liquids and solids, are given. Up to 47 constituents, primarily non-criteria parameters were checked. Analyses used and quality assurance/quality control results are given.

05 NUCLEAR FUELS

0501 Reserves, Exploration, and Mining

2160 (INIS-BR–1703) **Geochemical of the sodic-uranium metasomatic mineralization from Espinhas (PB)-Brazil.** Silveira, C.L.P. da. Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Quimica. 1986. 310p. (In Portuguese). Order Number DE90608131. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The radioactive deposit of Espinharas (PB) Brazil, situated in a complex of metamorphic and igneous precambrian rocks using analytical chemical methods, microchemical and radiochemical based on minetalogical and petrographical data is studied. (M.J.C.).

0504 Feed Processing

2161 (INIS-BR–1724) **Determination of HF in UF_4 contaminated by UO_2F_2.** Silva Queiroz, C.A. da; Abrao, A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607889. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. URANIUM FLUORIDES/ion exchange; URANIUM FLUORIDES/leaching; URANIUM TETRAFLUORIDE/impurities; AQUEOUS SOLUTIONS; RESINS; LEACHING; IMPURITIES; URANYL FLUORIDES; HYDROFLUORIC ACID

2162 (INIS-BR–1729) **Use of uranium in filtrated from preparation process uranium tetrafluoride by umid via.** Atalla, L.; Abrao, A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607892. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. URANIUM TETRAFLUORIDE/filtration; URANIUM TETRAFLUORIDE/organic ion exchangers; AMMONIUM HYDROXIDES; ION EXCHANGE; SOLUBILITY; FILTRATION

0505 Uranium Enrichment

Refer also to citation(s) 2249

0507 Fuels Production and Properties

Refer also to citation(s) 2438, 2449, 2477, 2488, 2489, 2838, 2919, 3050, 4193

2163 (BARC–1447) **Fuel Chemistry Division annual progress report for 1986.** Marathe, S.G.; Aggarwal, S.K. (eds.) (Bhabha Atomic Research Centre, Bombay (India). Fuel Chemistry Div.). Bhabha Atomic Research Centre, Bombay (India). 1989. 155p. Order Number DE90607954. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The research and development activities of the Fuel Chemistry Division during 1986 are reported in the form of summaries. These activities mainly deal with nuclear fuel development, the chemistry of actinides and solid and solution state, analytical methods for chemical quality control of fuels and other related materials. (M.G.B.).

2164 (CONF-8909141–5-Draft) **Status of high-density fuel plates fabrication: Final draft.** Wiencek, T.C.; Domagala, R.F.; Thresh, H.R. Argonne National Lab., IL (USA). Sep 1989. 11p. Sponsored by U.S. Arms Control and Disarmament Agency; U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies; U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep

1989. Order Number DE90001435. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Progress has continued on the fabrication of fuel plates with fuel zone loadings approaching 9gU/cm^3. Using Hot Isostatic Pressing (HIPping) successful diffusion bonds have been made with 110 Al and 6061 Al alloys. These bonds demonstrated the most critical processing step for proof-of-concept hardware. Two types of prototype highly-loaded fuel plates have been fabricated. First, a fuel plate in which 0.030 in. (0.76 mm) uranium compound wires are bonded within an aluminum cladding and second, a dispersion fuel plate with uniform cladding and fuel zone thickness. The successful fabrication of these fuel plates derives from the unique ability of the HIPping process to produce diffusion bonds with minimal deformation. 2 refs., 3 figs.

2165 (WSRC-RP-89-355) **Improved neutron monitor systems for Savannah River Site separations facilities.** Griffin, J.C. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8910260--1: Plutonium/uranium recovery operations conference, Oak Ridge, TN (USA), 24-26 Oct 1989). Order Number DE90001307. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Savannah River Laboratory (SRL), in conjunction with Savannah River Site (SRS) Separations Technology personnel, has developed and implemented a comprehensive program to improve the performance and reliability of neutron detector systems (neutron monitors) in the SRS separations areas. The neutron monitors, which monitor the buildup of fissile material in the mixer-settler banks of the solvent extraction process, are important nuclear safety control devices. A review of the performance history of the neutron monitors reveals that many of the systems exhibit problems arising from several causes, including: low neutron sensitivity, high susceptibility to electromagnetic interferences (due to long cable runs between detectors and their electronics), and high maintenance requirements. To address these problems, the neutron monitor improvement program encompasses both technical and administrative improvements, including: substitution of more sensitive neutron monitors at many locations in the solvent extraction areas, the development of an integrated preamplifier/amplifier package to eliminate long cable runs, and improvements in the neutron monitor functional test procedures to reduce maintenance requirements. The implementation of these improvements, already partially complete, is expected to provide enhanced operation and reliability for the neutron monitors. This paper will present a description of the solvent neutron monitors as well as technical details of the improvement program. 2 refs., 5 figs., 1 tab.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 2222, 2241, 2246, 2247, 2449, 2459, 2502, 2509, 3064, 4544

2166 (BNWL-CC-2048) **The reaction of gaseous Iodoethane with silver nitrate.** du Plessis, L.A. Battelle Pacific Northwest Lab., Richland, WA (USA). 14 Mar 1969. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE90001662. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Airborne radioactive wastes from nuclear fuel reprocessing plants are rigorously controlled. The most important of the volatile fission products is ^{131}I, whose significance as an airborne waste product stems from the low permissible concentration in air for inhalation and from the marked potential for concentration in food chains leading to man. Iodine is effectively removed from off-gases by passing the stream through heated beds of Berl saddles which have been coated with silver nitrate. These beds were developed on the assumption that elemental iodine alone is present; however, it is suspected that some of the iodine in reprocessing plants is present as organic iodides, particularly iodomethane. It is of interest to know what reactions take place between silver nitrate and gaseous organic iodides and how fast these reactions are. This study was undertaken to gain better understanding of the reactions of organic iodides and silver nitrate. Iodomethane was used in these laboratory studies rather than iodomethane to avoid the unstable methyl nitrate which is a product of the reaction between methyl iodide and silver nitrate. Helium was used as an inert sweep gas for the iodomethane to avoid results complicated by side reactions. 11 refs., 10 figs., 4 tabs.

2167 (INIS-BR-1672) **Evaluation of the utilization of neutron activation analysis for measuring non-irradiated nuclear fuels for safeguards.** Almeida, M.C.M. de; Santana Carvalho, J.L. de. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607956. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only.

2168 (INIS-BR-1710) **Determination of U-235 quantity in non-irradiated nuclear fuels using the neutrons coincidence method.** Menlove, H.O.; Marzo, M.A.S.; Almeida, S.G. de; Almeida, M.C.M. de; Conti, L.F.; Moitta, L.P.M.; Paiva, J.R.T. Industrias Nucleares do Brasil SA, Rio de Janeiro, RJ (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607957. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. URANIUM 235/coincidence methods; URANIUM 235/nuclear fuels; AMERICIUM; CALIBRATION; LITHIUM; NEUTRONS; QUANTITY RATIO

2169 (INIS-BR-1730) **Thorium re-improvement of residues from thorium purification plants.** Brandao Filho, D.; Hespanhol, C.B.; Baba, S.; Mirandi, L.E.T.; Araujo, J.A. de. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607879. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. THORIUM/purification; THORIUM/radioactive wastes; PH VALUE; SOLVENT EXTRACTION; THORIUM; PURIFICATION

2170 (ORNL/TM-11023) **Results of the Manipulator Test Test Stand study: Comparison of manipulators and evaluation of equipment items.** Kring, C.T.; Schrock, S.L.; Draper, J.V.; Hayashi, S.; Kawakami, H.; Horii, S.; Omori, E.; Fujita, Y. Oak Ridge National Lab., TN (USA). Aug 1989. 36p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90000977. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes the results of a study jointly conducted by staff members of the Consolidated Fuel Reprocessing Program at the Oak Ridge National Laboratory (ORNL) in the United States and the Power Reactor and Nuclear Fuel Development Corporation (PNC) in Japan. This study was initiated under the Remote Systems Technology Exchange Program and continued as part of the Joint Collaboration on Reprocessing Technology, each representing agreements between the United States Department of Energy and PNC. The purpose of the study was to evaluate the performance of servomanipulator systems developed by the respective participants as part of their in-cell maintenance systems for use in future nuclear fuel reprocessing facilities. The following servomanipulators were tested: (1) the Central Research Laboratory's model M-2, (2) the advanced servomanipulator (ASM), and (3) the Meidensha Prototype-2 (P-2). A series of experimental tasks and a test platform called the Manipulator Test Test Stand (MTTS) were jointly designed by ORNL and PNC. An evaluation of the servomanipulator system was based on the time required to complete these tasks. PNC and ORNL consider these tasks to be typical of those required for future reprocessing applications. 1 ref., 10 figs., 5 tabs.

2171 (WHC-SA-0616) **Recent plutonium metal production experience at Hanford.** Gibson, M.W.; Nyman, D.H. Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-891103--46: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90003361. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Plutonium metal is produced at the Hanford Site in the Remote Mechanical C (RMC) line. The line is housed in the Plutonium Finishing Plant (PFP). The RMC line was built in the early 1960s and operated until 1973 when it was shut down. The line was restarted in 1985 and has operated on a campaign basis since that time. The

fiscal years (FY) 1988/89 RMC line campaigns have shown improved yields and plant safety performance when compared to previous years. This is attributed to numerous process improvements that have been made in the line and to an enhanced standard of disciplined operations. This report discusses the improvements made to the RMC line.

0509 Transport and Storage

Refer also to citation(s) 2523

2172 (INIS-BR–1721) **Safety in transport and storage of radioactive materials.** Mezrahi, A.; Xavier, A.M. Instituto Brasileiro do Petroleo, Rio de Janeiro, RJ (Brazil). 1987. 19p. (In Portuguese). (CONF-8705395–: 5. Seminar on Industrial Safety, Fortaleza (Brazil), 26-29 May 1987). Order Number DE90608621. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The increasing utilization of radioisotopes in Industrial, Medical and Research Facilities as well as the processing of Nuclear Materials involve transport activities in a routine basis. The present work has the following main objectives: (I) the identification of the safety aspects related to handling, transport and storage of radioactive materials; (II) the orientation of the personnel responsible for the radiological safety of Radioactive Installations viewing the elaboration and implementation of procedures to minimize accidents; (III) the report of case-examples of accidents that have occured in Brazil due to non-compliance with Transport Regulations. (author).

2173 (NUREG–0383-Vol.1-Rev.12) **Directory of certificates of compliance for radioactive materials packages: Report of NRC approved packages: Volume 1, Revision 12.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation. Oct 1989. 476p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A21/MF A01 - GPO - OSTI.

The purpose of this directory is to make available a convenient source of information on packaging which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance Number is included at the front of Volume 2 of the directory. A listing by packaging types is included in the back of Volume 2. An alphabetical listing by Company name is included in the back of Volume 3 for approved QA programs. The reports include a listing of all users of each package design and approved QA programs prior to the publication date of the directory. Shipments of radioactive material utilizing these packages must be in accordance with the provisions of 49 CFR §173.471 and 10 CFR Part 71, as applicable. In satisfying the requirements of Section 71.12, it is the responsibility of the licensees to insure themselves that they have a copy of the current approval and conduct their transportation activities in accordance with a Nuclear Regulatory Commission approved quality assurance program.

2174 (NUREG–0383-Vol.2-Rev.12) **Directory of certificates of compliance for radioactive materials packages: Certificates of compliance: Volume 2, Revision 12.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation. Oct 1989. 632p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A99/MF A01 - GPO - OSTI.

The purpose of this directory is to make available a convenient source of information on packaging which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance Number is included at the front of Volume 2 of the directory. A listing by packaging types is included in the back of Volume 2. An alphabetical listing by Company name is included in the back of Volume 3 for approved QA programs. The reports include a listing of all users of each package design and approved QA programs prior to the publication date of the directory. Shipments of radioactive material utilizing these packages must be in accordance with the provisions of 49 CFR §173.471 and 10 CFR Part 71, as applicable. In satisfying the requirements of Section 71.12, it is the responsibility of the licensees to insure themselves that they have a copy of the current approval and conduct their transportation activities in accordance with a Nuclear Regulatory Commission approved quality assurance program.

0520 Waste Management

Refer also to citation(s) 2243, 2244, 2440, 2471, 2523, 2529, 2538, 2985, 3515, 3804, 3812, 3816

2175 (AEEW-M–2536) **Immobilisation in cement of ion exchange resins arising from the purification of reagents used for the decontamination of reactor circuits. Fourth semestrial report January-June 1988.** Howard, C.G.; Jolliffe, C.B.; Lee, D.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Sep 1988. 27p. (CPDG–(88)-P118). Order Number DE90608837. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The process developed previously for the immobilisation of Ion Exchange resin in cement has been scaled up to 200 litres. Large scale samples produced exhibit acceptable compressive strengths and dimensional stabilities. Destructive examination has shown that these samples are homogeneous and monolithic. A number of samples have been stored under water, this appears to have no detrimental effects on the dimensional stability and elastic modulus when compared to samples stored in air. Finally, a description of leach test work initiated using waste ion exchange resin treated with LOMI from the reactor at Winfrith is given. This work will be performed in accordance with the ISO leach test procedure. (author).

2176 (AEEW-R–1903) **Ultrasonic and immersion cleaning: a comparison using aqueous and fluorocarbon solvents.** Bond, R.D.; Kearsey, A. UKAEA Atomic Energy Establishment, Winfrith (UK). Materials Technology Div. Nov 1984. 30p. Order Number DE90608332. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Decontamination is a necessary process in reducing radiation levels in the working environment in the nuclear industry. Components from active areas which require decontamination for re-use or maintenance operations. In this report, a typical chemical cleaning process using liquid pumping, air agitation and physical movement for agitation is compared with ultrasonic cleaning, now an established cleaning process in many industries. The chosen traditional method is immersion in an agitated solution of warm SDG.3 solution; an established decontaminating reagent. The decontamination effect of this process is compared with the effect of cleaning in an ultrasonic bath containing the same reagent at the same concentration and temperature. Fluorocarbon reagents are of particular interest to the nuclear industry for they offer the ability to clean electrical components without damage, and can clean product contaminated material without the risk of criticality. Such reagents are based on 1,1,2-trichloro, 1,2,2-trifluoroethane and azeotropic mixtures. This reagent and one mixture with 6% methanol were tested under agitation and ultrasonic immersion at the same temperature. Parallel control experiments were conducted using demineralised water as the cleaning media in an agitated bath. SGG3 is a good reagent for general purpose cleaning (it can remove 99% of particulate contamination) using scrubbing, immersion or spraying techniques. There is little evidence to show that ultrasonic cleaning increases its effectiveness. For special purpose fluorocarbon solvents will give satisfactory results when used in an ultrasonic system. (author).

2177 (AEEW-R–2094) **Rheological measurements on cement grouts.** Dalton, M.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Jun 1986. 34p. Order Number DE90608838. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report describes the techniques which have been developed at Winfrith for assessing the rheological properties of cement grouts. A discussion of the theory of rheology and its application to cement is given and the methodology for calibrating a special paddle measuring system for a commercial viscometer is described. The use of the system for determining flow curves, equilibrium viscosity, viscosity as a function of shearing time and structure changes is also discussed. (author).

2178 (AERE-R–12939) **Evolution of pH in a radwaste repository: internal reactions between concrete constituents.** Atkinson, A.; Everitt, N.M.; Guppy, R.M. UKAEA Harwell Lab. (UK). Materials Development Div. Jan 1988. 46p. (DOE-RW–89.025(pt.2)). Available from H.M. Stationery Office, London, price Pound 10.00.

The pH is an important characteristic of the chemical conditions within a radioactive waste repository. A high pH is particularly beneficial from a variety of points of view and this can be assured by the use of cementitious materials within the repository. Reactions between repository components which have an influence on pH have been studied in accelerated laboratory experiments. The reactions studied were those occurring in modified cements (specifically 90% pulverized fly ash/10% ordinary Portland cement and 90% blast furnace slag/10% OPC) and between aqueous calcium hydroxide and both crystalline and amorphous SiO_2. The experiments indicate that extensive use of fuel ash leads to uncertainty in long term pH which could be as low as 9 to 10 in such cases. Experiments with crystalline calcium silicon hydrate (CSH) minerals suggest that crystallization of amorphous CSH could also lead to pH being lower than the optimum. (author).

2179 (AERE-R–12955) **Management of tritium wastes in the United Kingdom. A survey of present and future arisings, review of possible disposal options and areas where further R and D may be needed to develop a management strategy for the future.** Jones, D.V.C.; McHugh, G. UKAEA Harwell Lab. (UK). Materials Development Div.; Department of the Environment, London (UK). Oct 1988. 82p. (DOE-RW–89.004). Available from H.M. Stationery Office, London, price Pound 14.00.

A site specific survey of current and future amounts of tritium produced and subsequent waste arisings in the UK has been carried out. Various management options in addition to that of dilute and disperse have been indicated as possible disposal strategies for the future. Their impact on the dose received by the UK population, specific groups and the rest of the world has been assessed by the NRPB. This assessment shows that the present disposal strategy results in doses to the UK population which are considered insignificant in terms of risk and will remain so as the civil reactor programme increases in the future. The study also indicates that the extent to which tritium is used in research, medicine, industry and for consumer applications needs to be assessed. It will enable a more complete management strategy for the future to be defined. (author).

2180 (CONF-891053–5) **Effectiveness of interim remedial actions at a radioactive waste facility.** Devgun, J.S.; Beskid, N.J.; Peterson, J.M.; Seay, W.M.; McNamee, E. Argonne National Lab., IL (USA). [1989]. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?; Richland, WA (USA); 16-19 Oct 1989. Order Number DE90001940. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Over the past eight years, several interim remedial actions have been taken at the Niagara Falls Storage Site (NFSS), primarily to reduce radon and gamma radiation exposures and to consolidate radioactive waste into a waste containment facility. Interim remedial actions have included capping of vents, sealing of pipes, relocation of the perimeter fence (to limit radon risk), transfer and consolidation of waste, upgrading of storage buildings, construction of a clay cutoff wall (to limit the potential groundwater transport of contaminants), treatment and release of contaminated water, interim use of a synthetic liner, and emplacement of an interim clay cap. An interim waste containment facility was completed in 1986. 6 refs., 3 figs.

2181 (CONF-891197–2) **Nondestructive assay and nondestructive examination of remote-handled transuranic waste at the ORNL waste handling and packaging plant.** Schultz, F.J.; Caldwell, J.T. Oak Ridge National Lab., TN (USA). [1989]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. From Topical meeting on non-destructive assay of radioactive waste; Cadarache (France); 20-22 Nov 1989. Order Number DE90003076. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The purpose of this investigation is to examine the use of an electron linear accelerator (LINAC) in the performance of nondestructive assay (NDA) and nondestructive examination (NDE) measurements of remote-handled transuranic wastes. The system will be used to perform waste characterization and certification activities at the Oak Ridge National Laboratory's proposed Waste Handling and Packaging Plant. The NDA and NDE technologies which were developed for contact-handled wastes are inadequate to perform such measurements on high gamma and neutron dose-rate wastes. A single LINAC will provide the interrogating fluxes required for both NDA and NDE measurements of the wastes. 11 refs., 6 figs.

2182 (CONF-8906240–1) **Impact of technology applications to the management of low-level radioactive wastes.** Devgun, J.S. Argonne National Lab., IL (USA). [1989]. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 8. annual meeting on impact assessment in an age of transformation; Montreal (Canada); 24-28 Jun 1989. Order Number DE90002194. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Low-level radioactive wastes are generated from reactor sources (nuclear power reactors) as well as from nonreactor sources (academic, medical, governmental, and industrial). In recent years, about 50,000 m^3 per year of such wastes have been generated in the United States and about 10,000 m^3 per year in Canada. Direct disposal of these wastes in shallow ground has been a favored method in both countries in the past. In the United States, three operating commercial sites at Barnwell, South Carolina; Beatty, Nevada; and Richland, Washington, receive most of the commercial low-level waste generated. However, with recent advances in waste management, technologies are being applied to achieve optimum goals in terms of protection of human health and safety and the environment, as well as cost-effectiveness. These technologies must be applied from the generation sources through waste minimization and optimum segregation – followed by waste processing, conditioning, storage, and disposal. A number of technologies that are available and can be applied as appropriate – given the physical, chemical, and radiological characteristics of the waste – include shredding, baling, compaction, supercompaction, decontamination, incineration, chemical treatment/conditioning, immobilization, and packaging. Interim and retrievable storage can be accomplished in a wide variety of storage structures, and several types of engineered disposal facility designs are now available. By applying an integrated approach to radioactive waste management, potential adverse impacts on human health and safety and the environment can be minimized. 15 refs., 1 fig., 1 tab.

2183 (CONF-8906241–1) **Demonstration of a computer model for residual radioactive material guidelines, RESRAD.** Yu, C.; Yuan, Y.C.; Zielen, A.J.; Wallo, A. III. Argonne National Lab., IL (USA). [1989]. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 30. annual meeting of the Institute of Nuclear Materials Management; Orlando, FL (USA); 12 Jun 1989. Order Number DE90001771. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A computer model was developed to calculate residual radioactive material guidelines for the US Department of Energy (DOE). This model, called RESRAD, can be run on IBM or IBM-compatible microcomputer. Seven potential exposure pathways from contaminated soil are analyzed, including external radiation exposure and internal radiation exposure from inhalation and food digestion. The RESRAD code has been applied to several DOE sites to derive soil cleanup guidelines. The experience gained indicates that a comprehensive set of site-specific hydrogeologic and geochemical input parameters must be used for a realistic pathway analysis. The RESRAD code is a useful tool; it is easy to run and very user-friendly. 6 refs., 12 figs.

2184 (CONF-8910239–3) **Training waste generators: The first responder in proper waste management.** Jones, E. Oak Ridge National Lab., TN (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. annual TRADE conference; Baltimore, MD (USA); 22-25 Oct 1989. Order Number DE90002087. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Dealing with waste effectively requires a "cradle to grave" approach to waste management. The first step in that chain of custody is the waste generator. The waste generator plays the key role in the correct identification, packaging, and disposal of waste. The Technical Resources and Training Section at the Oak Ridge National Laboratory (ORNL) has developed several short training programs for waste generators. This training presents a consistent approach to proper handling of waste within the ORNL waste management system. This training has been developed for generators

of solid low-level radioactive waste, hazardous and mixed waste, and transuranic waste. In addition to the above, a Waste Minimization training program has been developed for use by all organizations at ORNL who generate any type of hazardous waste. These training programs represent a combined effort of the training staff and the technical staff to assure that all ORNL staff accept their responsibility for handling all types of radioactive and hazardous wastes correctly from its generation to its disposal. 4 refs.

2185 (CONF-8911110–1) **Technology transfer in hazardous waste management.** Drucker, H. Argonne National Lab., IL (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium on environmental perspectives towards the year 2000 and beyond; Bangkok (Thailand); 6-10 Nov 1989. Order Number DE90001905. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Hazardous waste is a growing problem in all parts of the world. Industrialized countries have had to deal with the treatment and disposal of hazardous wastes for many years. The newly industrializing countries of the world are now faced with immediate problems of waste handling. The developing nations of the world are looking at increasing quantities of hazardous waste generation as they move toward higher levels of industrialization. Available data are included on hazardous waste generation in Asia and the Pacific as a function of Gross Domestic Product (GDP). Although there are many inconsistencies in the data (inconsistent hazardous waste definitions, inconsistent reporting of wastes, etc.) there is definite indication that a growing economy tends to lead toward larger quantities of hazardous waste generation. In developing countries the industrial sector is growing at a faster rate than in the industrialized countries. In 1965 industry accounted for 29% of GDP in the developing countries of the world. In 1987 this had grown to 37% of GDP. In contrast, industry accounted for 40% of GDP in 1965 in industrialized countries and dropped to 35% in 1987. This growth in industrial activity in the developing countries brings an increase in the need to handle hazardous wastes. Although hazardous wastes are ubiquitous, the control of hazardous wastes varies. The number of regulatory options used by various countries in Asia and the Pacific to control wastes are included. It is evident that the industrialized countries, with a longer history of having to deal with hazardous wastes, have found the need to use more mechanisms to control them. 2 refs., 2 figs.

2186 (DOE/ID–10233(88)) **Site characterization program at the radioactive waste management complex of the Idaho National Engineering Laboratory: Annual progress report: FY-1988.** McElroy, D.L.; Rawson, S.A.; Hubbell, J.M.; Minkin, S.C.; Baca, R.G.; Vigil, M.J.; Bonzon, C.J.; Landon, J.L.; Laney, P.T. EG and G Idaho, Inc., Idaho Falls, ID (USA). Jul 1989. 54p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90002005. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

The Radioactive Waste Management Complex (RWMC) Site Characterization Program is a continuation of the Subsurface Investigation Program (SIP). The scope of the SIP has broadened in response to the results of past work that identified hazardous as well as radionuclide contaminants in the subsurface environment and in response to the need to meet regulatory requirements. Two deep boreholes were cored at the RWMC during FY-1988. Selected sediment samples were submitted for Appendix IX of 40 CFR Part 264 and radionuclide analyses. Detailed geologic logging of archived core was initiated. Stratigraphic studies of the unsaturated zone were conducted. Studies to determine hydrologic properties of sediments and basalts were conducted. Geochemical studies and analyses were initiated to evaluate contaminant and radionuclide speciation and migration in the Subsurface Disposal Area (SDA) geochemical environment. Analyses of interbed sediments in boreholes D15 and 8801D did not confirm the presence of radionuclide contamination in the 240-ft interbed. Analyses of subsurface air and groundwater samples identified five volatile organic compounds of concern: carbon tetrachloride, trichloroethylene, 1,1,1-trichloroethane, chloroform, and tetrachloroethylene. 33 refs., 5 figs., 2 tabs.

2187 (DOE/NE–0098) **1988 annual report on low-level radioactive waste management progress.** USDOE Assistant Secretary for Nuclear Energy, Washington, DC (USA). Oct 1989. 154p. Sponsored by U.S. DOE Nuclear Energy. Order Number DE90001779. Available from NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This report summarizes the progress of States and low-level radioactive waste compacts in 1988 in establishing new low-level waste disposal facilities, and also provides summary information on the volume of low-level waste received for disposal in 1988 by commercially-operated low-level waste disposal facilities. The report is in response to Section 7(b) of the Low-Level Radioactive Waste Policy Amendments Act of 1985.

2188 (DOE/RW–0245) **OCRWM program elements change control procedures.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA). Aug 1989. 34p. Sponsored by U.S. DOE Radioactive Waste Management. Available from OSTI.

This procedure prescribes responsibilities and the process for the issue, revision, replacement, and transmittal of the OCRWM Program Element-level controlled baselines, documents, and data bases. The Program Elements change control procedure applies to all OCRWM elements and contractors performing work for OCRWM.

2189 (DOE/WIPP–89-007) **Quality assurance guidance for TRUPACT-II [Transuranic Package Transporter-II] payload control.** Westinghouse Electric Corp., Carlsbad, NM (USA). Oct 1989. 74p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-86AL31950. Order Number DE90002490. Available from NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The Transuranic Package Transporter-II (TRUPACT-II) Safety Analysis Report for Packaging (SARP) approved by the Nuclear Regulatory Commission (NRC), discusses authorized methods for payload control in Appendix 1.3.7 and the Quality Assurance (QA) requirements in Section 9.3. Subsection 9.3.2.1 covers maintenance and use of the TRUPACT-II and the specific QA requirements are given in DOE/WIPP 89-012. Subsection 9.3.2.2 covers payload compliance, for which this document was written. 6 refs.

2190 (DOE/WIPP–89-009-Vol.1) **Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 1.** Westinghouse Electric Corp., Carlsbad, NM (USA). Engineering and Repository Technology Dept. Aug 1989. 132p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-86AL31950. Order Number DE90002492. Available from NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

The Geotechnical Field Data and Analysis Report (GFDAR) is prepared to provide a timely assessment of the geotechnical status of the Waste Isolation Pilot Plant (WIPP). During the period of shaft sinking and construction of the principal underground access and experimental areas, reporting was on a quarterly basis. Because geotechnical responses of existing underground facilities have slowed to nearly steady-state and excavation of the waste storage panels will take place more slowly and over an extended period, reporting in the coming years will be on an annual cycle. Data collected before June 30 of the year of the report will be presented and analyzed. This report presents and analyzes all data collected between July 31, 1987, and June 30, 1988. 35 refs., 47 figs.

2191 (DOE/WIPP–89-009-Vol.2) **Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 2.** Westinghouse Electric Corp., Carlsbad, NM (USA). Engineering and Repository Technology Dept. Aug 1989. 488p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-86AL31950. Order Number DE90002493. Available from NTIS, PC A21/MF A01; OSTI; INIS; GPO Dep.

The Geotechnical Field Data and Analysis Report (GFDAR) is prepared to provide a timely assessment of the geotechnical status of the Waste Isolation Pilot Plant (WIPP). During the period of shaft sinking and construction of the principal underground access and experimental areas, reporting was on a quarterly basis. Because excavation of the waste storage panels will take place more slowly and over an extended period, reporting in the coming years will be on an annual cycle. Data collected before June 30 of the year of the report will be presented and analyzed. This report presents and

analyzes all data collected between July 31, 1987, and June 30, 1988. 3 refs., 410 figs., 30 tabs.

2192 (DOE/WIPP–89-014) **Waste Isolation Pilot Plant (WIPP) TRU waste shipment dry run preoperational checkout plan.** Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div. Jun 1989. 13p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-86AL31950. Order Number DE90002491. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Waste Isolation Pilot Plant (WIPP) is a major system acquisition authorized as a research and development facility to demonstrate safe disposal of both remote-handled (RH) and contact-handled (CH) transuranic defense waste in bedded salt. In addition to these full-scale demonstrations, WIPP will provide facilities for experimentation with radioactive materials. This plan documents the scope for the preoperational checkout of the shipment of transuranic defense waste from generator/storage (shipper) sites to the WIPP facility. As readiness is a phased effort, portions or all of this plan may be exercised at a given time. It has been prepared in compliance with the WIPP Waste Transportation Manual, WP 06-2. Results from the preoperational checkout establish the basis for a preoperations checkout report to be used for WIPP and generator/storage site operational readiness review activities. A separate preoperational checkout and preoperational checkout report will be performed and prepared for each site upon completion of the demonstration. 4 refs.

2193 (EGG-M–88181) **Risk assessment and risk management for an experimental nuclear waste processing facility.** Reny, D.A.; Mackowiac, D.P.; Stallman, R.M. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8811282–1: Society of Risk Analysis annual conference, Washington, DC (USA), 1 Nov 1988). Order Number DE90002092. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The purpose of this paper is to describe the application of probabilistic risk assessment (PRA) techniques and risk management of an experimental nuclear waste processing facility. The Process Experimental Pilot Plant (PREPP) is an experimental Transuranic (TRU) waste processing facility. The facility is located at the Idaho National Engineering Laboratory (INEL). PREPP is owned by the US Department of Energy and operated under contract by EG&G Idaho, Inc. 4 refs., 4 figs., 2 tabs.

2194 (EGG-M–89302) **Shielding design for spent fuel shipping in high-capacity truck casks.** Boshoven, J.K.; Su, Shiaw-Der. EG and G Idaho, Inc., Idaho Falls, ID (USA); General Atomics, San Diego, CA (USA). [1989]. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570;AC07-88ID12698. (CONF-891103–37: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90002076. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

General Atomics (GA), under contract to the US Department of Energy (DOE), is developing a high-capacity legal weight truck transportation system for shipment of pressurized-water-reactor (PWR) and boiling-water-reactor (BWR) spent fuels from commercial nuclear power plants to a repository or monitored retrievable storage facility. The system includes two cask versions optimized for PWR and BWR fuels, respectively. The PWR version carries four fuel assemblies designated the GA-4 cask; and the BWR version accommodates nine fuel assemblies designated the GA-9 cask. This paper presents the shielding aspects of the GA-4 and GA-9 casks. 5 refs., 1 fig.

2195 (EPRI-NP–5673) **Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report.** Murphy, E.S.; Rogers, V.C. Electric Power Research Inst., Palo Alto, CA (USA); Rogers and Associates Engineering Corp., Salt Lake City, UT (USA). c Nov 1989. 88p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Technical factors associated with the Environmental Protection Agency's proposed dose criterion for the disposal of Low-Level Radioactive Wastes (LLRW) as Below Regulatory Concern (BRC) wastes are reviewed and updated with more recent waste stream data. The new analysis also includes a separate evaluation of the nuclear power plant waste component and a consideration of risks from the transportation of BRC wastes to a disposal site other than a NRC licensed LLRW disposal site. The nuclear power plant analysis supports a higher BRC dose criterion than the generic analysis, which includes nuclear power plant, institutional, and industrial waste streams. 13 refs., 8 figs., 19 tabs.

2196 (EUR–11776) **Performance assessment of geological isolation systems for radioactive waste. Disposal in clay formations.** Marivoet, J.; Bonne, A. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 749p. Available from NTIS (US Sales Only), PC A99/MF A01.

In the framework of the PAGIS project of the CEC Research Programme on radioactive waste, performance assessment studies have been undertaken on the geological disposal of vitrified high-level waste in clay layers at a reference site at Mol (B) and a variant site at Harwell (UK). The calculations performed for the reference site shown that most radionuclides decay to negligible levels within the first meters of the clay barrier. The maximum dose rates arising from the geological disposal of HLW, as evaluated by the deterministic approach are about 10^{-11} Sv/y for river pathways. If the sinking of a water well into the 150 m deep aquifer layer in the vicinity of the repository is considered together with a climatic change, the maximum calculated dose rate rises to a value of 3.10^{-7} Sv/y. The calculated maxima arise between 1 million and 15 million years after disposal. The maximum dose rates evaluated by stochastic calculations are about one order of magnitude higher due to the considerable uncertainties in the model parameters. In the case of the Boom clay the estimated consequences of a fault scenario are of the same order of magnitude as the results obtained for the normal evolution scenario. The maximum risk is estimated from stochastic calculations to be about 4.10^{-8} per year. For the variant site the case of the normal evolution scenario has been evaluated. The maximum dose rates calculated deterministically are about 1.10^{-6} Sv/y for river pathways and 6.10^{-5} Sv/y for a water well pathways; these doses would occur after about 1 million years. This document is one of a set of 5 reports covering a relevant project of the European Community on a nuclear safety subject having very wide interest. The five volumes are: the summary (EUR 11775-EN), the clay (EUR 11776-EN), the granite (EUR 11777-FR), the salt (EUR 11778-EN) and the sub-seabed (EUR 11779-EN).

2197 (EUR–11777) **Disposal in granite formations.** Van Kote, F.; Peres, J.M.; Olivier, M.; Lewi, J.; Assouline, M.; Mejon-Goula, M.J. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 802p. (In French). Available from NTIS (US Sales Only), PC A99/MF A01.

In the framework of the PAGIS project of the CEC Research Programme on radioactive wastes, a performance assessment of a repository of vitrified HLW in granite was carried out. Three disposal sites were considered: the reference site Auriat and two alternative sites, Barfleur and a site in the U.K. The report describes the methodology adopted (a deterministic and a stochastic approach) with the corresponding data base and the models used. A parametric study of sub-systems (near field, far field and biosphere) was carried out by CEA-ANDRA using AQUARIUS, DIMITRIO and BIOS. A global evaluation of the performances was carried out by CEA-IPSN using MELODIE code. The results of deterministic calculations showed for Auriat a maximum dose equivalent evaluated at 6.10^{-3}m Sv/a arising 3 millions years after disposal. Results of human intrusion scenario analyses, uncertainty analyses and global sensitivity analyses are presented. This document is one of a set of 5 reports covering a relevant project of the European Community on a nuclear safety subject having very wide interest. The five volumes are: the summary (EUR 11775-EN), the clay (EUR 11776-EN), the granite (EUR 11777-FR), the salt (EUR 11778-EN) and the sub-seabed (EUR 11779-EN).

2198 (EUR–11778) **Disposal in salt formations.** Storck, R.; Aschenbach, J.; Hirsekorn, R.P.; Nies, A.; Stelte, N. Commission of

the European Communities, Luxembourg (Luxembourg). 1988. 786p. Available from NTIS (US Sales Only), PC A99/MF A01.

In the framework of the PAGIS project of the CEC Research Programme on radioactive waste, a performance assessment of a repository of vitrified HLW in rock salt formations has been carried out. The first volume of the study is split into four tasks. Task 1 recalls the main steps that have led to the selection of the reference and the variant site. Task 2 condenses all information available on the rock formations which are planned to host the repository, the overlying geosphere and the geohistoric development of the sites. Task 3 states the technical details of repository planning, while in Task 4 conceivable release scenarios are discussed. Volume II (Tasks 5 to 10) is concerned with the modelling procedures. In Task 5 data for the waste inventory are collected and the selection of relevant nuclides for transport calculations is discussed. Task 6 gives the near-field modelling, i.e. the models for corrosion of the waste canisters, the degradation of the waste matrix and the models used for the HLW boreholes. Task 7 deals with the modelling of the repository. Its division into sections is discussed and models for physical and chemical effects taken into account in each section are presented. In Task 8 the modelling of the overburden is given. In Task 9 additional models for the subrosion scenario and a human intrusion scenario are given. Task 10 is concerned with the biosphere modelling. In Volume III results of deterministic and probabilistic calculations are presented. Task 11 gives the results for deterministic calculations with best estimate values for the parameters involved in the models. Task 12 presents the result of the uncertainty analysis, and Task 13 those of local and global sensitivity analyses followed by concluding remarks. This document is one of a set of 5 reports covering a relevant project of the European Community on a nuclear safety subject having very wide interest.

2199 (EUR–11779) **Disposal into the sub-seabed.** Mobbs, S.F.; Charles, D.; Delow, C.E.; McColl, N.P. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 815p. Available from NTIS (US Sales Only), PC A99/MF A01.

This report describes an assessment of the radiological impact of sub-seabed disposal of vitrified high level waste, carried out as part of the PAGIS project of the CEC Research Programme on radioactive waste. Where possible the data used in this study have been taken from those provided by the Nuclear Energy Agency Seabed Working Group. The waste was assumed to be placed into the subseabed sediments by means of the free fall penetrator technique. An alternative method, emplacement in a deep borehole, was also studied. Three disposal sites were considered: the reference site Great Meteor East, in the N.E. Atlantic, and two alternative sites: Southern Nares Abyssal Plain in the N.W. Atlantic and Cape Verde Rise in N.E. Atlantic. Models were used to describe the release of radionuclides from the waste, their migration through the sediments, their dispersion in the world oceans and the pathways to man. For the normal evolution scenario, best estimate peak individual dose rates for the penetrator option was evaluated at 2×10^{-10} Sv y^{-1} arising 0.1 million years after emplacement. The collective dose commitment was 10,000 man Sv. The corresponding figures for the borehole option were 2×10^{-14} Sv y^{-1} and 1 man Sv. The risks from seven altered evolution scenarios were also calculated and the risk was predicted to be always less than 10^{-9} y^{-1}. Uncertainty and sensitivity analyses were also performed and showed that the peak dose was most sensitive to variations in Kd values, pore water velocity, pore water diffusivity and burial depth. This document is one of a set of 5 reports covering a relevant project of the European Community on a nuclear safety subject having very wide interest. The five volumes are: the summary (EUR 11775-EN), the clay (EUR 11776-EN), the granite (EUR 11777-FR), the salt (EUR 11778-EN) and the sub-seabed (EUR 11779-EN).

2200 (INIS-mf–12018) **Hydrogeological, geohydraulic and geothermal studies in projected final storage sites for radioactive waste. Pt. 3. Geothermal studies. Final Report.** Kopietz, J. Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Sep 1988. 187p. (In German). Contract BMFT KWA 53090;BMFT KWA 85050;BMFT KWA 8504 9/2. Order Number DE90721986. Available from NTIS (US Sales Only), PC A09/MF A01.

The report contains: (1) a survey of the measurements carried out; (2) temperature and temperature gradient logs from the surface rock of the salt dome of Gorleben; (3) isoline and three-dimensional presentations of the surface rock temperatures; (4) temperature and temperature gradient logs from the deep borings Go 1002, 1003 and 1004 and the primary shaft borings Go 5001 and 5002. (orig./HP).

2201 (LA-UR–89-3354) **Analysis of caisson transport experiments by travel time approach.** Nguyen, V.; Dagan, G.; Springer, E.P. Los Alamos National Lab., NM (USA). [1989]. 15p. Sponsored by U.S. DOE Defense Programs; U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-8909261–1: Workshop on field-scale water and solute flux in soils, Monte Verita (Switzerland), 24-29 Sep 1989). Order Number DE90002433. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The transport experiments conducted by Los Alamos National Laboratory in an intermediate-scale caisson are described. The results suggest that the solute spreading pattern has been dominated by the effect of spatial variability of hydraulic properties. A stochastic model of horizontally varying velocity distribution is employed in order to interpret the concentration data in terms of travel time distribution. A satisfactory match between the measured solute mass cross-sectional transfer in saturated flow and model is achieved for a standard deviation of the logconductivity of 1.2. The model may serve for interpretation of transport in unsaturated flow and for reactive solutes. 14 refs., 7 figs.

2202 (LA-UR–89-3355) **Analyses of transport in the upper soil layer and interpretation of caisson experiments.** Dagan, G.; Nguyen, V.; Springer, E. Los Alamos National Lab., NM (USA). [1989]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890928–11: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90002432. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The transport experiments conducted by Los Alamos National Laboratory in an intermediate-scale caisson are described. The results suggest that the solute spreading pattern has been dominated by the effect of spatial variability of hydraulic properties. A stochastic model of horizontally varying velocity distribution is employed in order to interpret the concentration data. A satisfactory match between the measured solute mass cross-sectional transfer in saturated flow and model is achieved for a standard deviation of the logconductivity of 1.2. The model may serve for interpretation of transport in unsaturated flow and for reactive solutes. 11 refs., 7 figs.

2203 (LA-UR–89-3410) **Magnetic separation as a plutonium residue enrichment process.** Avens, L.R.; McFarlan, J.T.; Gallegos, U.F. Los Alamos National Lab., NM (USA). 1989. 39p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891013–6: 6. symposium on separation science and technology for energy applications, Knoxville, TN (USA), 22-27 Oct 1989). Order Number DE90002384. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have subjected several plutonium contaminated residues to Open Gradient Magnetic Separation (OGMS) on an experimental scale. Separation of graphite, bomb reduction sand, and bomb reduction sand, and bomb reduction sand, slag, and crucible, resulted in a plutonium rich fraction and a plutonium lean fraction. The lean fraction varied between about 20% to 85% of the feed bulk. The plutonium content of the lean fraction can be reduced from about 2% in the feed to the 0.1% to 0.5% range dependent on the portion of the feed rejected to this lean fraction. These values are low enough in plutonium to meet economic discard limits and be considered for direct discard. Magnetic separation of direct oxide reduction and electrorefining pyrochemical salts gave less favorable results. While a fraction very rich in plutonium could be obtained, the plutonium content of the lean fraction was to high for direct discard. This may still have chemical processing applications. OGMS experiments at low magnetic field strength on incinerator ash did give two fractions but the plutonium content of each fraction was essentially identical. Thus, no chemical processing advantage was identified for magnetic separation of this residue. The detailed results of these experiments and the implications for OGMS use in recycle plutonium processing are discussed. 4 refs., 3 figs., 9 tabs.

2204 (LA-UR–89-3503) **Preliminary integrated calculation of radionuclide cation and anion transport at Yucca Mountain using a geochemical model.** Birdsell, K.H.; Campbell, K.; Eggert, K.G.; Travis, B.J. Los Alamos National Lab., NM (USA). [1989]. 21p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-36. (CONF-890928–12: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90002402. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper presents preliminary transport calculations for radionuclide movement at Yucca Mountain using preliminary data for mineral distributions, retardation parameter distributions, and hypothetical recharge scenarios. These calculations are not performance assessments, but are used to study the effectiveness of the geochemical barriers at the site at mechanistic level. The preliminary calculations presented have many shortcomings and should be viewed only as a demonstration of the modeling methodology. The simulations were run with TRACRN, a finite-difference porous flow and radionuclide transport code developed for the Yucca Mountain Project. Approximately 30,000 finite-difference nodes are used to represent the unsaturated and saturated zones underlying the repository in three dimensions. Sorption ratios for the radionuclides modeled are assumed to be functions of mineralogic assemblages of the underlying rock. These transport calculations present a representative radionuclide cation, ^{135}Cs and anion, ^{99}Tc. The effects on transport of many of the processes thought to be active at Yucca Mountain may be examined using this approach. The model provides a method for examining the integration of flow scenarios, transport, and retardation processes as currently understood for the site. It will also form the basis for estimates of the sensitivity of transport calculations to retardation processes. 11 refs., 17 figs., 1 tab.

2205 (LBL–24805-Rev.) **Variable temperature effects on release rates of readily soluble nuclides: Revision.** Kim, C.-L.; Light, W.B.; Lee, W.W.-L.; Chambre, P.L.; Pigford, T.H. Lawrence Berkeley Lab., CA (USA). Sep 1988. 3p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (CONF-880903–53-Rev.: Spectrum '88: international topical meeting on nuclear and hazardous waste management, Pasco, WA (USA), 11-15 Sep 1988). Order Number DE90002449. Available from NTIS, PC A02/MF A01; OSTI; INIS.

In this paper we study the effect of temperature on the release rate of readily soluble nuclides, as affected by a time-temperature dependent diffusion coefficient. In this analysis ground water fills the voids in the waste package at t = 0 and one percent of the inventories of cesium and iodine are immediately dissolved into the void water. Mass transfer resistance of partly failed container and cladding is conservatively neglected. The nuclides move through the void space into the surrounding rock under a concentration gradient. We use an analytic solution to compute the nuclide concentration in the gap or void, and the mass flux rate into the porous rock. 8 refs., 4 figs.

2206 (LBL–26703) **Mass transport in salt repositories: Transient diffusion into interbeds.** Hwang, Y.; Lee, W.W.-L.; Chambre, P.L.; Pigford, T.H. Lawrence Berkeley Lab., CA (USA). May 1989. 20p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (UCB-NE–4137). Order Number DE90003299. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

To estimate possible radioactive releases from a waste package to the near-field environment, we analyzed pressure-driven brine migration movement and release rates of low-solubility and readily soluble nuclides by diffusion. A possible pathway for radioactive release in salt repositories in interbeds and we have analyzed the steady-state transport of species through the interbeds in which there is ground-water flow. A more realistic situation is when there is no ground-water flow in the interbeds. Here we use some results previously obtained for transient diffusion of radioactive species from a waste cylinder intersecting a planar fracture in rock to the problem of diffusion from a waste cylinder intersecting an interbed in a salt repository. 5 refs., 8 figs., 3 tabs.

2207 (LBL–26704) **Mass transport in salt repositories: Steady-state transport through interbeds.** Hwang, Y.; Lee, W.W.-L.; Chambre, P.L.; Pigford, T.H. Lawrence Berkeley Lab., CA (USA). Mar 1989. 13p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (UCB-NE–4136). Order Number DE90003294. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Salt has long been a candidate for geologic disposal of nuclear waste. Because salt is extremely soluble in water, the existence of rock salt in the ground atest to the long-term stability of the salt. Both bedded salt and salt domes have been considered for nuclear waste disposal in the United States and Europe. While the salt is known to be quite pure in salt domes, bedded salt is interlaced with beds of sediments. Traditionally rock salt has not been considered water-conducting, but sediments layers would be classical porous media, capable of conducting water. Therefore there is interest in determining whether interbeds in bedded salt constitute pathway for radionuclide migration. In this report we consider steady-state migration of radionuclides from a single waste cylinder into a single interbed. Two approaches are used. In 1982 Neretnieks proposed an approach for calculating the steady-state transport of oxidants to a copper container. We have adapted that approach for calculating steady-state radionuclide migration away from the waste package, as a first approximation. We have also analyzed the problem of time-dependent radionuclide diffusion from a container through a backfill layer into a fracture, and we used the steady-state solution from that problem for comparison. Section 2 gives a brief summary of the geology of interbeds in bedded salt. Section 3 presents the mass transfer resistances approach of Neretnieks, summarizing the formulation and giving numerical illustrations of the steady-state two-dimensional diffusion analysis. Section 4 gives a brief statement of the steady-state result from a related analysis. Conclusions are stated in Section 5. 13 refs., 5 figs., 2 tabs.

2208 (LBL–26780) **Geotechnical support and topical studies for nuclear waste geologic repositories: Annual report, fiscal year 1988.** Lawrence Berkeley Lab., CA (USA). Jan 1989. 177p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. Order Number DE90002614. Available from NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.

The present report lists the technical reviews and comments made during the fiscal year 1988 and summarizes the technical progress of the topical studies. In the area of technical assistance, there were numerous activities detailed in the next section. These included 24 geotechnical support activities, including reviews of 6 Study Plans (SP) and participation in 6 SP Review Workshops, review of one whole document Site Characterization Plan (SCP) and participation in the Assembled Document SCP Review Workshops by 6 LBL reviewers; the hosting of a DOE program review, the rewriting of the project statement of work, 2 trips to technical and planning meetings; preparation of proposed work statements for two new topics for DOE, and 5 instances of technical assistance to DOE. These activities are described in a Table in the following section entitled "Geoscience Technical Support for Nuclear Waste Geologic Repositories."

2209 (LBL–26827) **Analytical models for C-14 transport in a partially saturated, fractured, porous media.** Light, W.B.; Pigford, T.H.; Chambre, P.L.; Lee, W.W.-L. Lawrence Berkeley Lab., CA (USA). Feb 1989. 9p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (CONF-890928–16: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90003079. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Interaction between fractures and rock matrix is considered in developing a criterion for treating fractured rock as a porous medium for the purpose of transport calculations. The value of a modified Peclet number determines the suitability of the equivalent porous medium approach. Using a porous medium mode, underground concentrations of $^{14}CO_2$ are predicted for the proposed nuclear waste repository at Yucca Mountain, Nevada. Maximum concentrations near the ground surface are comparable to the USNRC limit for unrestricted areas; travel times are predicted to be hundreds to thousands of years for the assumed parameter values. 8 refs., 7 figs.

2210 (LBL–26828) **Release rates of soluble species at Yucca Mountain.** Lee, W.W.-L.; Pigford, T.H. Lawrence Berkeley Lab., CA (USA). Feb 1989. 7p. Sponsored by U.S. DOE Radioactive

Waste Management. DOE Contract AC03-76SF00098. (CONF-890928–15: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90003267. Available from NTIS, PC A02/MF A01; OSTI; INIS.

Experimental leaching of spent fuel shows that some fission product species are preferentially released upon contact with water. We analyze the conservative case of bare spent fuel in contact with saturated tuff using diffusional mass transfer analysis. For the parameter values used, the USNRC release rate limit is not exceeded, except for ^{99}Tc. The presence of a container and the distribution of water contact over time will assist in meeting this criterion. 6 figs., 2 tabs.

2211 (LBL–27225) **Gas flow in and out of a nuclear waste container.** Zwahlen, E.D.; Pigford, T.H.; Chambre, P.L.; Lee, W.W.L. Lawrence Berkeley Lab., CA (USA). May 1989. 4p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (CONF-891103–45: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989; UCB-NE–4149). Order Number DE90003081. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We analyze the flow of gases out of and into a high-level-waste container in the unsaturated tuff of Yucca Mountain. Containers are expected to fail eventually by localized cracks and penetrations. Even though the penetrations may be small, argon gas initially in the hot container can leak out. As the waste package cools, the pressure inside the container can become less than atmospheric, and air can leak in. ^{14}C released from the hot fuel-cladding surface can leak out of penetrations, and air inleakage can mobilize additional ^{14}C and other volatile radioactive species as it oxidizes the fuel cladding and the spent fuel. In an earlier paper we studied the gas flow through container penetrations occurring at the time of emplacement. Here we analyze the flow of gas for various penetration sizes occurring at 300 years. 3 refs., 2 figs.

2212 (LBL–27429) **Analytic solution of pseudocolloid migration in fractured rock.** Hwang, Y.; Pigford, T.H.; Lee, W.W.L.; Chambre, P.L. Lawrence Berkeley Lab., CA (USA). Jun 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (UCB-NE–4156;CONF-891103–41: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90002684. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A form of colloid migration that can enhance or retard the migration of a dissolved contaminant in ground water is the sorption of the contaminant on the moving colloidal particulate to form pseudocolloids. In this paper we develop analytical solutions for the interactive migration of radioactive species dissolved in ground water and sorbed as pseudocolloids. The solute and pseudocolloids are assumed to undergo advection and dispersion in a one-dimensional flow field in planar fractures in porous rock. Interaction between pseudocolloid and dissolved species is described by equilibrium sorption. Sorbed species on the pseudocolloids undergo radioactive decay, and pseudocolloids can sorb on fracture surfaces and sediments. Filtration is neglected. The solute can decay and sorb on pseudocolloids, on the fracture surfaces, and on sediments and can diffuse into the porous rock matrix. 1 fig.

2213 (NUREG–1351) **Standard Review Plan for a petition for rulemaking on radioactive waste streams below regulatory concern: Expedited review in accordance with Appendix B to 10 CFR, Part 2: Data report for comment.** Larkins, P.M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Low-Level Waste Management and Decommissioning. Oct 1989. 176p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A09/MF A01 - GPO; OSTI; INIS.

The Standard Review Plan (SRP) provides guidance to staff reviewers acting on rulemaking petitions in an expeditious manner to exempt from regulation radioactive waste determined to be Below Regulatory Concern (BRC), as called for in the Low-Level Radioactive Waste Policy Amendments Act of 1985. The review plan is designed to ensure the quality and uniformity of staff reviews and to present a well-defined basis for the staff's evaluation of BRC petitions. The plan serves to improve the understanding of the staff's review by interested members of the public and the industry. It also provides information about the BRC rulemaking process to a wider audience. 6 refs., 7 figs.

2214 (NUREG/CP–0103) **Workshop on cement stabilization of low-level radioactive waste: Proceedings.** Nuclear Regulatory Commission, Washington, DC (USA); National Inst. of Standards and Technology (NCTL), Gaithersburg, MD (USA). Oct 1989. 232p. Sponsored by Nuclear Regulatory Commission. (NISTIR–89-4178;CONF-8905152–: Workshop on cement stabilization of low-level radioactive waste, Gaithersburg, MD (USA), 31 May - 2 jun 1989). Available from NTIS, PC A11/MF A01 - GPO; OSTI; INIS.

The Workshop on Cement Stabilization of Low-Level Radioactive Waste was co-sponsored by the US Nuclear Regulatory Commission and National Institute of Standards and Technology and held in Gaithersburg, Maryland on May 31–June 2, 1989. The workshop provided a forum for exchanging information on the solidification and stabilization of low-level radioactive waste in cement among federal and state regulators, nuclear power station operators, cement vendors, national laboratory researchers and consultants. The workshop was structured into a "Plenary" and four "Working Group" sessions. Each working group session discussed a set of specific issues as follows: Working Group 1, "Lessons Learned from Small- and Full-Scale Waste Forms and Observations at Nuclear Power Stations", Working Group 2, "Laboratory Test Experience and Application to Problem Waste Streams", Working Group 3, "Stabilized Waste Form Testing Guidance", and Working Group 4, "Waste Characterization, Solidification, and Process Control Programs (PCP)."

2215 (NUREG/CR–5430-Vol.1) **FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1.** Board, M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; Itasca Consulting Group, Inc., Minneapolis, MN (USA). Oct 1989. 175p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A08/MF A01 - GPO; OSTI; INIS.

FLAC (Fast Lagrangian Analysis of Continua), Version 2.20, is a two-dimensional, large-strain, explicit finite difference code written for analysis of problems in geotechnical engineering. FLAC has the ability to perform static mechanical analyses as well as transient heat transfer and fluid flow simulations. Various constitutive models are available to describe linear and non-linear response of the solid. Coupling can be performed between the thermal and mechanical, as well as the fluid and mechanical, models. This report presents the documentation specified in NUREG-0856, Documentation of Computer Codes for High Level Waste Management. The documentation is presented in three volumes. This document, Volume 3, presents FLAC verification, example and benchmark problems.

2216 (NUREG/CR–5430-Vol.2) **FLAC (Fast Lagrangian Analysis of Continua), Version 2.20: User's manual.** Board, M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; Itasca Consulting Group, Inc., Minneapolis, MN (USA). Oct 1989. 506p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A22/MF A01 - GPO; OSTI; INIS.

FLAC (Fast Lagrangian Analysis of Continua), Version 2.20, is a two-dimensional, large-strain, explicit finite difference code written for analysis of problems in geotechnical engineering. FLAC has the ability to perform static mechanical analyses as well as transient heat transfer and fluid flow simulations. Various constitutive models are available to describe linear and non-linear response of the solid. Coupling can be performed between the thermal and mechanical, as well as the fluid and mechanical, models. The following report presents the documentation specified in NUREG-0856, Documentation of Computer Codes for High Level Waste Management. The documentation is presented in three volumes. Volume 1 contains the mathematical basis for the various aspects of the code; Volume 2 is the code User's Manual, and Volume 3 presents FLAC verification, example and benchmark problems. 5 refs., 81 figs., 3 tabs.

2217 (NUREG/CR–5430-Vol.3) **FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Verification, example and benchmark problems: Volume 3.** Board, M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; Itasca Consulting Group, Inc., Minneapolis, MN

(USA). Oct 1989. 279p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A13/MF A01 - GPO; OSTI; INIS.

FLAC (Fast Lagrangian Analysis of Continua), Version 2.20, is a two-dimensional, large-strain, explicit finite difference code written for analysis of problems in geotechnical engineering. FLAC has the ability to perform static mechanical analyses as well as transient heat transfer and fluid flow simulations. Various constitutive models are available to describe linear and non-linear response of the solid. Coupling can be performed between the thermal and mechanical, as well as the fluid and mechanical, models. The following report presents the documentation specified in NUREG-0856, Documentation of Computer Codes for High Level Waste Management. The documentation is presented in three volumes. Volume 1 contains the mathematical basis for the various aspects of the code; Volume 2 is the code User's Manual, and this document, Volume 3, presents FLAC verification, example and benchmark problems. 5 refs., 135 figs.

2218 (NUREG/CR–5441) **Soil physical properties at the Las Cruces trench site.** Wierenga, P.J.; Toorman, A.F.; Hudson, D.B.; Vinson, J.; Nash, M.; Hills, R.G. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Arizona Univ., Tucson, AZ (USA). Dept. of Soils, Water and Engineering; New Mexico State Univ., Las Cruces, NM (USA). Nov 1989. 92p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

Computer modelling has become an essential part of the licensing process of low level waste disposal sites. Validation of models requires high quality data from carefully controlled field experiments. This report provides the soil physical data obtained at a field site near Las Cruces, New Mexico. A large trench was constructed in undisturbed soil to provide horizontal access to irrigated plots on the sides of the trench and to provide soil samples. Details are provided on the construction of the trench and on the physical properties of the samples collected during construction of the trench. A total of 594 disturbed samples and 594 core samples were collected. Morphological characteristics of the soil at the site are presented, as well as data on the saturated hydraulic conductivity determined in the field with the bore hole permeameter and in the laboratory with a constant head method. Soil water retention data, particle size distribution data, and bulk density data are also provided. The van Genuchten equation was fitted to the soil water retention data and the parameters fitted in this equation are presented in the report. All results are presented in tabular form, ASCII format on a floppy disk available at the Nuclear Energy Software Center (NESC) Argonne National Laboratory. 3 figs., 51 tabs.

2219 (NUREG/CR–5466) **Service life of concrete.** Clifton, J.R.; Knab, L.I. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; National Inst. of Standards and Technology, Gaithersburg, MD (USA). Nov 1989. 98p. Sponsored by Nuclear Regulatory Commission. (NISTIR–89-4086). Available from NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

The US Nuclear Regulatory Commission (NRC) has the responsibility for developing a strategy for the disposal of low-level radioactive waste (LLW). An approach being considered for their disposal is to place the waste forms in concrete vaults buried in the earth. A service life of 500 years is required for the concrete vaults as they may be left unattended for much of their lives. This report examines the basis for making service life predictions based on accelerated testing and mathematical modeling of factors controlling the durability of concrete buried in the ground. Degradation processes are analyzed based on considerations of their occurrence, extent of potential damage, and mechanisms. A recommended research plan for developing methods for predicting the service life of concrete is presented. The major degradation processes that concrete of underground vaults will likely encounter are sulfate attack, corrosion of reinforcing steel, alkali-aggregate reactions, and leaching by ground water. Freezing and thawing damage could occur before the vaults are covered with soil and therefore are addressed. Other degradation processes which may occur are microbiological attack, salt crystallization, and attack by LLW, especially by acidic materials. Two important factors controlling the resistance of concrete to these degradation processes are its quality and permeability. Concepts of quality and factors affecting quality of concrete are discussed. Permeability is discussed in terms of the water-to-cement ratio, the pore structure of concrete, and the effects of cracks. 101 refs., 15 figs., 5 tabs.

2220 (ORNL/FTR–3457) **[Immobilization of technetium in blast furnace slag]: Foreign trip report, October 13, 1989–October 30, 1989.** McDaniel, E.W. Oak Ridge National Lab., TN (USA). 14 Nov 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE90002921. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler participated in a TRU technical specialist workshop at Mito, Japan, in accordance with the US/Japanese bilateral agreement on the management of TRU waste. The traveler also presented a paper entitled "Immobilization of Technetium in Blast Furnace Slag" and was a session chairman at the "Joint International Waste Management Conference." A site visit was made to Hiroshima University to inspect a wastewater treatment process for the removal of heavy metals.

2221 (PB–89-867741/XAB) **Radioactive waste storage sites: Reclamation and remedial action. January 1970-July 1989 (Citations from the NTIS data base). Report for January 1970-July 1989.** National Technical Information Service, Springfield, VA (USA). Aug 1989. 123p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning remedial-action programs to restore sites contaminated with radioactivity. Priority determination for remedial action, cleanup techniques, site surveys, site characterization and identification, environmental impacts of remedial action, technology for containment of contaminated materials, and programs and plans for eventual reclamation of existing facilities are among the topics discussed. Techniques of radioactive waste solidification, fixation, and vitrification are discussed in separate bibliographies. (Contains 203 citations fully indexed and including a title list.)

2222 (PB–89-870521/XAB) **Sol-gel processes. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 91p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868039.

This bibliography contains citations concerning the development and utilization of sol-gel processes and techniques. Topics include antireflective coatings, studies of sol-gel transitions, sol-gel synthesis and polymerization, sol-gel derived thin films and glasses, and sol-gel production of microspheres. Applications in nuclear waste management, nuclear-fuel manufacturing, glass optical waveguide development, and solar-energy collection are presented. (This updated bibliography contains 179 citations, 39 of which are new entries to the previous edition.)

2223 (PNCT-N–8410-89-008) **Plutonium diffusivity in compacted bentonite.** Idemitsu, Kazuya; Ishiguro, Katsuhiko; Yusa, Yasuhisa; Sasaki, Noriaki; Tsunoda, Naomi. Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan). Feb 1989. 15p. (CONF-8810441–: Workshop on artificial clay barriers for high level radioactive waste repositories, Lund (Sweden), 5-7 Oct 1988). Order Number DE90719555. Available from NTIS (US Sales Only), PC A03/MF A01.

Measurement on plutonium diffusivity in water-saturated compacted bentonite was carried out. Representative specimens of sodium bentonite were taken from Tsukinuno and Kuroishi mines situated in northeast Japan. Tsukinuno bentonite was divided into three types; raw type, purified Na-type, and H-type which was prepared by treating Na-type bentonite with hydrochloric acid. Kuroishi bentonite contained chlorite as impurity. H-type bentonite was used as reference for the convenience of profile measurement in bentonite, since plutonium diffusivity in H-type bentonite was considered to be larger than that in Na-type bentonite because of low pH and low swelling pressure of H-type bentonite. Sampled bentonite was compacted into pellet of 20 mm in diameter and 20 mm in height. Bulk densities of these specimens were 1200 to 1800 kg/m^3 for purified Na-type and H-type bentonite and 1600 kg/m^3 for raw type bentonite. Plutonium profiles obtained in H-type bentonite can be explained by diffusion equation with constant concentration source.

Diffusivity ranges from 10^{-13} to 10^{-12} m^2/s for H-type and Kuroishi impure sodium bentonite. Diffusivity in both raw type and purified Tsukinuno bentonite was estimated to be less than 10^{-14} m^2/s. Diffusivity in H-type bentonite showed a tendency to decrease with increasing density. Influence of quartz and hematite contents in bentonite was also studied. Quartz content up to 50% or hematite content up to 1% did not influence diffusivity significantly in H-type bentonite. The chemical species of plutonium in pore water of Na-type and H-type were estimated $Pu(OH)_3^+$ and PuO_2^+ respectively. (author).

2224 (PNCT-N–8410-89-009) **Static leaching of actinides and fission products from fully radioactive waste glass of HLLW generated in Tokai reprocessing plant.** Miyahara, K.; Ashida, T.; Yusa, Y.; Sasaki, N.; Tsunoda, N. Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan). Feb 1989. 15p. (CONF-881066–: 12. international symposium on the scientific basis for nuclear waste management, Berlin (Germany, F.R.), 10-13 Oct 1988). Order Number DE90719554. Available from NTIS (US Sales Only), PC A03/MF A01.

Fully radioactive waste glass of HLLW generated in Tokai Reprocessing Plant was produced by using a small Joule-heated ceramic melter at the Chemical Processing Facility (CPF), Tokai Works, PNC, Japan. Static leach tests using the glass were carried out in doubly distilled water for a period of up to three months at 30degC and 90degC. Gamma spectrometry was performed to measure ^{134}Cs, ^{137}Cs and ^{60}Co in the leachates. After the chemical separation of Cs isotopes in the leachates, it was newly possible to measure ^{125}Sb, ^{144}Ce, ^{154}Eu and ^{155}Eu. Alpha spectrometry was performed to measure ^{239}Pu + ^{240}Pu, ^{241}Am and ^{244}Cm in the leachates. Adsorption of the actinides on the wall of the leach vessel was recognized in all cases. Leaching behavior of the measured radionuclides were evaluated by considering mass balance of the radionuclides which were leached. (author).

2225 (PNL–7130) **Evaluation of the ground-water contaminant plume extending from the 183-H Solar Evaporation Basins.** Hall, S.H. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 29p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC06-76RL01830. Order Number DE90003091. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The 183-H Solar Evaporation Basins, located on the Hanford Site in southeastern Washington State, were used for solar concentration and storage of process wastes that consisted of nitric, sulfuric, and hydrofluoric acids, contaminated by heavy metals and radionuclides, and neutralized by sodium hydroxide. By 1977, it was apparent that leakage from the basins had reached the unconfined aquifer, causing elevated ground-water concentrations of nitrate, chromium, technetium-99, and uranium. The resulting plume is superimposed on a larger, pre-existing plume from upgradient sources that is characterized by the same contaminants, but with different relative concentrations. The plumes discharge into the Columbia River, 210 m from the basins. This study examines the relative concentration ratios of the contaminants, determines which wells in the monitoring network surrounding the basins have been affected by basin leakage, assigns reasonable plume boundaries, and shows the separate contribution of each plume to ground-water contamination downgradient from the basins. 10 refs., 8 figs., 4 tabs.

2226 (PNL-SA–16209) **Slurry-fed ceramic melter–A broadly accepted system to vitrify high-level waste.** Chapman, C.C.; McElroy, J.L. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891006–8: Joint international waste management conference, Kyoto (Japan), 23-28 Oct 1989). Order Number DE90002500. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Slurry (or liquid)-fed ceramic melters (LFCM) have been chosen for vitrifying liquid high-level radioactive waste (HLW) in projects around the world: three in the US, two in Japan, one in West Germany, and one in Belgium. This paper summarizes the experience with this technology, which has proven adaptable to the broadcast spectrum of wastes and throughputs. The generic technical issues of process and product requirements are reviewed, including differences among wastes and their processing challenges, such as throughput, elemental solubilities, corrosiveness, and preferred methods. In the US, waste-form qualification is currently the most critical issue needing acceptance before approval is received for startup of a vitrification plant. Product requirements as defined in the US waste acceptance specifications are translated into operational and technological requirements. Among these are sampling requirements, which are minimized using the LFCM process.

2227 (PNL-SA–16734) **A sensitivity study of near-field thermomechanical conditions in tuff.** Johnson, K.I.; Voss, C.F.; Sherwood, D.J. Pacific Northwest Lab., Richland, WA (USA). Aug 1989. 11p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. (CONF-890928–14: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90002663. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A study was conducted by the Pacific Northwest Laboratory to investigate the response of a discontinuous rock mass to the combined mechanical and thermal loads from the excavation of repository openings and decay heating of radioactive waste forms. The ANSYS finite element code was used to calculate temperatures and thermal stresses near an emplacement hole as a function of time. The UDEC distinct element code was used to simulate a discontinuous rock mass around the emplacement hole using the finite element stress results as boundary conditions. This approach differs from previous work in its approximation of the near-field geosphere as an assemblage of blocks that are free to slide and rotate relative to one another. The physical properties of the rock joints and fractures were explicitly included in the analysis. Earlier efforts have used continuum models that included the effects of discontinuities by adjusting material properties (reducing elastic modulus and rock strength) or using ubiquitous joints. A range of parameter values were used to represent the upper, lower, and expected conditions for the Yucca Mountain site. Assuming worst case conditions, the calculated displacements around the emplacement hole were only a small fraction of the design air gap between the waste package and the wall of the emplacement hole. Overall, the results confirm that the retrieval option and waste package lifetime will not be adversely affected by borehole instability and excessive rock loads. 8 refs., 6 figs., 4 tabs.

2228 (PNL-SA–16826) **Applicable or relevant and appropriate requirements (ARARs) for radioactive mixed waste.** Keller, J.F.; Woodruff, M.G. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891072–6: 27. Hanford symposium on health and the environment: multilevel research–molecules to man, Richland, WA (USA), 18-20 Oct 1989). Order Number DE90001900. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Radioactive mixed waste (RMW) refers to waste containing both chemicals and radionuclides. Sites that contain such wastes are subject to a complex regulatory framework. Currently, no single statute or regulation addresses all aspects of RMW management and cleanup. This paper reviews the federal environmental pollution control and radioactive waste management statutes and regulations that may contain applicable or relevant and appropriate requirements (ARARs) as defined under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Potential ARARs for the air, groundwater, surface water, soil, and overall exposure pathways are identified. Additional regulatory documents that contain potential standards are also identified. These requirements can be used in determining appropriate cleanup levels (or targets) for an RMW site. 19 figs., 6 tabs.

2229 (PNL-SA–16844) **Use of the Multimedia Environmental Pollutant Assessment System (MEPAS) for large- and small-scale applications.** Buck, J.W.; Aiken, R.J. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 10p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. (CONF-890964–1: 4. annual hazardous waste and hazardous materials management conference and exposition, San Francisco, CA (USA), 27-29 Sep 1989). Order Number DE90001898. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Multimedia Environmental Pollutant Assessment System (MEPAS) is an objective, physics-based computer code system that

provides a means of quantifying relative risks from contaminants released into the environment. A baseline survey of DOE's major operating facilities is being conducted to identify and rank environmental problems and areas of environmental risk. The MEPAS model was used on 208 groups of problems associated with 16 sites located in 12 different states. Within 1 year, 208 groups of problems and some 500 transport scenarios were assembled, data were input, and model runs were made and analyzed. Findings from the surveys conducted at the 16 DOE sites were used to identify preliminary environmental problems. Using the MEPAS methodology as a basis for the ranking, these environmental problems are being ranked according to relative potential public health and environmental impact. The resulting Hazard Potential Index (HPI) is used to develop a preliminary ranking for each of the environmental problems. As a part of the Environmental Survey, DOE has issued a preliminary summary report that includes a preliminary ranking of potential problems at 16 sites associated with DOE's defense production mission. A final summary report addressing all 35 of the major DOE sites will re-evaluate the preliminary ranking and will incorporates the results of the Survey's sampling and analysis. 6 refs.

2230 (PNL-SA–17164-HEDR) **The identification of terrain-induced circulations using principal components.** Skyllingstad, E.D.; Schwartz, M.N. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8910277–1: 11. conference of probability and statistics, Monterey, CA (USA), 1-5 Oct 1989). Order Number DE90001991. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The application of principal component analysis to regional wind fields can provide an objective method for the identification of synoptic, thermal, and topographical effects. These results can be applied to regional wind forecasting by providing a frequency distribution for various wind-field transitions from the current observed state or used in defining climatological wind fields for air quality studies. In future work, a principal component analysis of large-scale forcing will be combined with the regional wind-field study to provide a more objective link between synoptic and mesoscale patterns. Synoptic-scale situations from operational meteorological models could then be used to predict changes in the local wind field. 8 refs., 2 figs., 2 tabs.

2231 (PNL-SA–17267) **Recommendations for evaluating environmental monitoring programs for alternative low-level waste facilities.** Denham, D.H. Pacific Northwest Lab., Richland, WA (USA). Aug 1989. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-890854–14: 11. annual DOE low level waste management conference, Pittsburgh, PA (USA), 22-24 Aug 1989). Order Number DE90002733. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Licensing of low-level radioactive waste disposal facilities requires the review of the proposed environmental monitoring and surveillance programs, which is why the US Nuclear Regulatory Commission (NRC) Division of Low-Level Waste Management and Decommissioning has developed a draft Branch Technical Position paper, "Environmental Monitoring of Low-Level Radioactive Waste Disposal Facilities." In support of these program reviews, Pacific Northwest Laboratory prepared recommendations for NRC staff to use in evaluating the adequacy of proposed environmental monitoring programs during the preoperational, operational, and postoperational phases of low-level waste facility operations. These recommendations are documented in an NRC-sponsored report that includes review checklists for NRC staff to use in evaluating environmental monitoring and surveillance program compliance with applicable regulations, including both radiological and selected nonradiological parameters. The criteria applied to establish these review checklists were based on requirements established in the US Code of Federal Regulations. 28 refs.

2232 (PNL-SA–17359) **Trends in radionuclide concentrations for wildlife and food products near Hanford for the period 1971 through 1988.** Eberhardt, L.E.; Cadwell, L.L.; Price, K.R.; Carlile, D.W. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891053–7: 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?, Richland, WA (USA), 16-19 Oct 1989). Order Number DE90002673. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The objective of this summary investigation was to identify trends in radionuclide concentrations for wildlife and food products sampled from 1971 through 1988 as part of the Hanford Site Environmental Monitoring Program. No upward trends in radionuclide concentrations were detected for any wildlife or food products. Several sample types demonstrated significantly declining radionuclide concentrations. Three factors appeared to be responsible for the trends. First, the cessation of atmospheric testing by the United States and Soviet Union in 1971 contributed to the decline of radionuclides in some samples. Second, contaminants discharged to the Columbia River were reduced subsequent to the 1971 shutdown of the last Hanford nuclear reactor that used a once-through cooling water design. The reactor closing resulted in declines in activation products in oysters from Willapa Bay and in whitefish from the Hanford Reach of the Columbia River. Third, reductions in radionuclide concentrations in Hanford wildlife suggested a decreasing availability of environmental contaminants to wildlife. Remediation of areas having environmental surface contaminants on the Hanford Site was identified as a probable cause. 5 refs., 4 figs., 2 tabs.

2233 (SAND–88-2535) **Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt.** Munson, D.E.; Fossum, A.F.; Senseny, P.E. Sandia National Labs., Albuquerque, NM (USA). Aug 1989. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890628–4: 30. US symposium on rock mechanics, Morgantown, WV (USA), 19-22 Jun 1989). Order Number DE90002089. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The discrepancies between predicted and measured WIPP in situ Room D closures are markedly reduced through the use of a Tresca flow potential, an improved small strain constitutive model, an improved set of material parameters, and a modified stratigraphy. 12 refs., 5 figs., 1 tab.

2234 (SAND–88-2626C) **Predicting flow through low-permeability, partially saturated, fractured rock: A review of modeling and experimental efforts at Yucca Mountain.** Eaton, R.R.; Bixler, N.E.; Glass, R.J. Sandia National Labs., Albuquerque, NM (USA). [1989]. 39p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. (CONF-890702–4: 28. international geological congress, Washington, DC (USA), 9-19 Jul 1989). Order Number DE90002884. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Current interest in storing high-level nuclear waste in underground repositories has resulted in an increased effort to understand the physics of water flow through low-permeability rock. The US Department of Energy is investigating a prospective repository site located in volcanic ash (tuff) hundreds of meters above the water table at Yucca Mountain, Nevada. Consequently, mathematical models and experimental procedures are being developed to provide a better understanding of the hydrology of this low-permeability, partially saturated, fractured rock. Modeling water flow in the vadose zone in soils and in relatively permeable rocks such as sandstone has received considerable attention for many years. The treatment of flow (including nonisothermal conditions) through materials such as the Yucca Mountain tuffs, however, has not received the same level of attention, primarily because it is outside the domain of agricultural and petroleum technology. This paper reviews the status of modeling and experimentation currently being used to understand and predict water flow at the proposed repository site. Several areas of research needs emphasized by the review are outlined. The extremely nonlinear hydraulic properties of these tuffs in combination with their heterogeneous nature makes it a challenging and unique problem from a computational and experimental view point. 101 refs., 14 figs., 1 tab.

2235 (SAND–88-2734) **3D thermal stress analysis of WIPP [Waste Isolation Pilot Plant] Room T RH TRU [Remote Handled Transuranic] experiments.** Argueello, J.G.; Beraun, R.; Molecke, M.A. Sandia National Labs., Albuquerque, NM (USA). Aug 1989. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract

AC04-76DP00789. (CONF-890628–1: 30. US symposium on rock mechanics, Morgantown, WV (USA), 19-22 Jun 1989). Order Number DE90001883. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A three-dimensional finite element thermal stress analysis of the RH TRU experiments in WIPP Room T has been performed. This analysis aids in the interpretation of the borehole closure results being obtained from the Room T experiments and helps in assessing potential performance impacts in a typical storage room, during the waste retrieval period. Computed results are presented and compared to available in situ data, and a qualitative agreement between measured and computed closures is seen. 9 refs., 10 figs.

2236 (SAND–89-0386) **The Waste Isolation Pilot Plant (WIPP) Seal System Performance Program.** Nowak, E.J.; Tyler, L.D. Sandia National Labs., Albuquerque, NM (USA). Aug 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8905136–3: Joint NEA/CEC workshop on sealing of radioactive waste repositories, Braunschweig (Germany, F.R.), 22-25 May 1989). Order Number DE90001885. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Waste Isolation Pilot Plant (WIPP) Seal System Performance Program addresses the sealing of all manmade penetrations. Sealing concepts for shafts, drifts, and boreholes have been developed, and candidate seal materials were identified. Ongoing laboratory tests and model calculations have confirmed the potential effectiveness of reconsolidated WIPP crushed salt as a primary long-term seal material. Grouts based on crushed WIPP salt appear to be viable materials for sealing anhydritic interbeds at drift and panel seal locations. In situ tests have demonstrated the viability of concrete bulkheads as temporary seal materials that preserve the integrity of the seal system until the crushed salt components have reconsolidated sufficiently. Cementitious grouts have also been tested in WIPP boreholes drilled from the surface. Scaled in situ tests of crushed salt and bentonite (as a temporary seal material to prevent downflow of water into the crushed salt in shafts) are currently underway. Large scale seal tests and the development of models that predict the performance of seal systems are being developed from the test data. 13 refs., 6 figs.

2237 (UCRL–98308) **Application of the results of excavation response experiments at climax and the Colorado School of Mines to the development of an experiment for the underground research laboratory.** Ubbes, W.F.; Yow, J.L. Jr.; Hustrulid, W.A. Lawrence Livermore National Lab., CA (USA). 29 Apr 1988. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8804309–1: Organization for Economic Cooperation and Development/Nuclear Energy Agency Excavation Response workshop, Winnipeg (Canada), 29 Apr 1988). Order Number DE90002976. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Large-scale underground experiment programs to examine excavation response have been performed at the Climax facility in Nevada and at the Colorado School of Mines. These two programs provided fundamental information on the behavior of rock and the effects of excavation; on instrument performance and configuration; and on the relationship between test geometry and test behavior. This information is being considered in the development of a major excavation response experiment to be carried out in the Canadian Underground Research Laboratory. 11 refs., 3 figs.

2238 (UCRL–98729) **The EQ3/6 software package for geochemical modeling: Current status.** Worlery, T.J.; Jackson, K.J.; Bourcier, W.L.; Bruton, C.J.; Viani, B.E.; Knauss, K.G.; Delany, J.M. Lawrence Livermore National Lab., CA (USA). Jul 1988. 16p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. (CONF-880912–32: 196. American Chemical Society national meeting, Los Angeles, CA (USA), 25-30 Sep 1988). Order Number DE90002820. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

EQ3/6 is a software package for modeling chemical and mineralogic interactions in aqueous geochemical systems. The major components of the package are EQ3NR (a speciation-solubility code), EQ6 (a reaction path code), EQLIB (a supporting library), and a supporting thermodynamic data base. EQ3NR calculates aqueous speciation and saturation indices from analytical data. It can also be used to calculate compositions of buffer solutions for use in laboratory experiments. EQ6 computes reaction path models of both equilibrium step processes and kinetic reaction processes. These models can be computed for closed systems and relatively simple open systems. EQ3/6 is useful in making purely theoretical calculations, in designing, interpreting, and extrapolating laboratory experiments, and in testing and developing submodels and supporting data used in these codes. The thermodynamic data base supports calculations over the range 0-300°C. 60 refs., 2 figs.

2239 (UCRL–100603) **Evaluation of the post-emplacement environment of high level radioactive waste packages at Yucca Mountain, Nevada.** Glassley, W. Lawrence Livermore National Lab., CA (USA). Mar 1989. 16p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. (CONF-8903112–5: Waste management '89, Tucson, AZ (USA), 1 Mar 1989). Order Number DE90002816. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Evaluation of the post-emplacement environment around high level radioactive waste containers is required by federal regulations. The information derived from this evaluation will be used to determine the service performance of the waste containers, the chemical and hydrological conditions that may influence radionuclide release and transport if containers are breached, and retrievability of the waste containers prior to closure of the repository. Laboratory studies, numerical simulations, and field experiments and tests are used to provide data necessary for this evaluation. Results obtained to date demonstrate that the post-emplacement environment in the welded tuff at Yucca Mountain, Nevada maintains relatively benign chemical features (i.e., near neutral pH, low concentrations of dissolved species) for most scenarios. The hydrological environment appears to be one of low flow volume and rates for the expected condition of an unsaturated medium. Emplacement borehole stability will be a function of fracture density and orientation, which may be influenced by microcrack development. Field studies and numerical simulations are in progress that will extend the results of laboratory studies to long time periods. The extent to which chemical, hydrological and mechanical processes can be adequately coupled through numerical simulations remains a matter of concern. 18 refs., 4 figs., 1 tab.

2240 (UCRL–101285) **A kinetic model for dissolution of borosilicate glass.** Bourcier, W.L.; Knauss, K.G.; Merzbacher, C.I. Lawrence Livermore National Lab., CA (USA). 28 Sep 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-890867–3: 6. international symposium on water-rock interaction, Malvern (UK), 3-9 Aug 1989). Order Number DE90002817. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A kinetic model for the dissolution of borosilicate glass, incorporated into the EQ3/6 geochemical modeling code, is used to predict the dissolution rate of a nuclear waste glass. The glass dissolution rate is controlled by the rate of dissolution of an alkali-depleted amorphous surface gel layer. The good agreement between predicted and observed dissolution behavior suggests that the experimentally obtained non-linear glass release rates are not diffusion controlled, as previously believed, but are instead controlled by dissolution affinity. The model predicts that the long-term rate of glass dissolution will depend mainly on ion concentrations in solution, and therefore the secondary phased which precipitate and control ion concentrations. 4 refs., 5 figs., 1 tab.

0530 Environmental Aspects

Refer also to citation(s) 2181, 2182, 2184, 2186, 2201, 2202, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2218, 2220, 2225, 2226, 2227, 2228, 2231, 2232, 2233, 2235, 2236, 2237, 2238, 2239, 2240, 2487, 2529, 3504, 3515, 3594

2241 (NRPB-R–225) **Investigations of Iodine-129 in the natural environment: results and implications.** Wilkins, B.T. National Radiological Protection Board, Chilton (UK). Jun 1989. 23p. Available from H.M. Stationery Office, London, price Pound 4.00.

The distribution of iodine-129 in the terrestrial environment in west Cumbria is dominated by the continuous discharges from the

Sellafield plant to atmosphere. Although most of the iodine-129 discharged goes to sea, there is no evidence that sea-to-land transfer is significant for this radionuclide. An assessment of activity concentrations in foodstuffs confirms that consumption of cows' milk is the most important contributor to intake and shows the resultant committed effective dose equivalent is less than 0.5% of the present international dose limit, which for continuous exposure over a lifetime is 1 mSv y^{-1}. Transfer from feed to cows's milk has been followed during open pasture grazing in the summer and during the winter when the cows consume locally-produced silage. In both cases, transfer coefficients from feed to milk were lower than the consensus value currently employed for modelling purposes, but consistent with values derived more recently under a variety of field conditions. (author).

0540 Health and Safety

Refer also to citation(s) 2172, 2175, 2176, 2179, 2180, 2183, 2186, 2539, 3509, 3510, 3814, 4187

2242 (DOE/OR/21548–045-Rev.0) **Phase 1 spring and seep report: Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri: Revision 0.** MK-Ferguson Co., St. Charles, MO (USA); Jacobs Engineering Group, Inc., St. Charles, MO (USA). Aug 1989. 74p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-86OR21548. Order Number DE90002280. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

Pursuant to the overall objective of the WSSRAP to characterize the potential environmental and health impacts posed by the Weldon Spring Site, the Phase I Spring and Seep sampling effort was undertaken to evaluate the migration of site-related contaminants through conduit type groundwater flow. Samples were collected from springs during both high and low flow stages. Samples were analyzed for uranium, nitroaromatic compounds, CLP metals, and inorganic anions. Eight of the 27 springs which were sampled in a 2 mile radius of the site were found to contain levels of contaminants above calculated background levels. This report details the rationale, sampling and analytical methodologies, the analytical results, and the interpretation of transport mechanisms for each of the positive results. 12 refs., 4 figs., 7 tabs.

2243 (PNL–6972) **Remediation of DOE hazardous waste sites: Planning and integration requirements.** Geffen, C.A.; Garrett, B.A.; Cowan, C.E.; Siegel, M.R.; Keller, J.F. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. Order Number DE90002513. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Energy (DOE) is faced with a immense challenge in effectively implementing a program to mitigate and manage the environmental impacts created by current operations and from past activities at its facilities. The current regulatory framework and public interest in the environmental arena have made operating DOE facilities in an environmentally responsible manner a compelling priority. This paper provides information on the results of a project funded by DOE to obtain a better understanding of the regulatory and institutional drivers in the hazardous waste market and the costs and timeframes required for remediation activities. Few realize that before remediating a hazardous waste site, a comprehensive planning process must be conducted to characterize the nature and extent of site contamination, calculate the risk to the public, and assess the effectiveness of various remediation technologies. The US Environmental Protection Agency (EPA) and others have found that it may take up to 7 years to complete the planning process at an average cost of $1.0 million per site. While cost information is not yet available for DOE sites, discussions with hazardous waste consulting firms indicate that average characterization and assessment costs will be 5 to 10 times this amount for DOE sites. The higher costs are expected because of the additional administrative requirements placed on DOE sites, the need to handle mixed wastes, the amount and extent of contamination at many of these sites, and the visibility of the sites. 15 refs., 1 fig., 2 tabs.

2244 (PPA-T–7) **Radiation hazard from the tantalum dumps in Penang.** Unit Tenaga Nuklear, Bangi, Selangor (Malaysia). [1989]. 26p. Order Number DE90608330. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The radiation level at the dumps are well above background. The readings taken on the dumps themselves range from 1000 mrem/year to 5860 mrem/year. The radiation levels in the houses close to the dump at Hill Railway Road were much lower, in the range of 160 mrem/year to 335 mrem/year. However, the level recorded at a house on Medan Tembaga is higher, being around 650 mrem/year. It is worth noting that the maximum permissible dose as recommended by the International Commission on Radiological Protection for the general public is 500 mrem/year and the average background radiation level is around 80-90 mrem/year. (author).

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 2165, 2502, 3054

2245 (IAEA-INFCIRC–369) **Agreement of 20 September 1988 between the People's Republic of China and the International Atomic Energy Agency for the application of safeguards in China.** International Atomic Energy Agency, Vienna (Austria). Oct 1989. 33p. Order Number DE90608880. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Hard copies are available in Chinese from IAEA Div. of Publications, Distribution Unit.

The document contains two parts. The first part stipulates the agreement of China to accept IAEA safeguards on all source or special fissionable material in peaceful nuclear facilities to be designated by China within its territory with a view to enabling the Agency to verify that such material is not withdrawn, except as provided for in this Agreement, from those facilities while such material is subject to safeguards under this Agreement. The second part specifies the procedures to be applied in the implementation of the safeguards provisions of Part I.

2246 (LA-UR–89-3699) **Measurements of plutonium residues from recovery processes.** Hsue, S.-T.; Langner, D.G.; Longmire, V.L.; Menlove, H.O.; Russo, P.A.; Sprinkle, J.K. Jr. Los Alamos National Lab., NM (USA). [1989]. 13p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-36. (CONF-891197–3: Topical meeting on non-destructive assay of radioactive waste, Cadarache (France), 20-22 Nov 1989). Order Number DE90003170. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Conventional methods of nondestructive assay (NDA) have accurately assayed the plutonium content of many forms of relatively pure and homogeneous bulk items. However, physical and chemical heterogeneities and the high and variable impurity levels of many categories of processing scrap bias the conventional NDA results. The materials also present a significant challenge to the assignment of reference values to process materials for purposes of evaluating the NDA methods. A recent study using impure, heterogeneous, pyrochemical residues from americium molten salt extraction (MSE) has been aimed at evaluating NDA assay methods based on conventional gamma-ray and neutron measurement techniques and enhanced with analyses designed to address the problems of heterogeneities and impurities. The study included a significant effort to obtain reference values for the MSE spent salts used in the study. Two of the improved NDA techniques, suitable for in-line assay of plutonium in bulk, show promise for timely in-process assays for one of the most difficult pyrochemical residues generated as well as for other impure heterogeneous scrap categories. 12 refs., 4 figs., 5 tabs.

2247 **Applying AI techniques to improve alarm display effectiveness.** Gross, J.M. (Westinghouse Idaho Nuclear Co., Idaho Falls, ID (US)); Birrer, S.A.; Crosberg, D.R. pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

The Alarm Filtering System (AFS) addresses the problem of information overload in a control room during abnormal operations. Since

operators can miss vital information during these periods, systems which emphasize important messages are beneficial. AFS uses the artificial intelligence (AI) technique of object-oriented programming to filter and dynamically prioritize alarm messages. When an alarm's status changes, AFS determines the relative importance of that change according to the current process state. AFS bases that relative importance on relationships the newly changed alarm has with other activated alarms. Evaluations of a alarm importance take place without regard to the activation sequence of alarm signals. The United States Department of Energy has applied for a patent on the approach used in this software. The approach was originally developed by EG and G Idaho for a nuclear reactor control room.

0560 Legislation and Regulations

Refer also to citation(s) 2173, 2174, 2195, 2243, 2467, 2468, 2538, 4196

2248 (CNEN-NE–1.13) **Licesing of mining and milling facilities of uranium and/or thorium ores.** Knoefel, M.J.; Carneiro, M.B.; Sila Estrada, J.J. da and others. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Normas e Especificacoes. Jul 1989. 28p. (In Portuguese). (DNE–40). Available from Centro de Informacoes Nucleares of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

The objective of this norm is to regulate the licesing process of mines and mills facilities of uranium and thorium ores. This process is used for activities related with location, construction and operation of those mines and mills.

2249 (K/ITP–111) **Uranium enrichment export control guide: Gaseous diffusion.** Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div. Sep 1989. 63p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE90002423. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document was prepared to serve as a guide for export control officials in their interpretation, understanding, and implementation of export laws that relate to the Zangger International Trigger List for gaseous diffusion uranium enrichment process components, equipment, and materials. Particular emphasis is focused on items that are especially designed or prepared since export controls are required for these by States that are party to the International Nuclear Nonproliferation Treaty.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

Refer also to citation(s) 3065

0702 Radiation Sources

Refer also to citation(s) 3697, 3698, 4435

2250 (IAERU–8802, pp. 3-27) **Neutron radiography and its image resolutions.** Kobayashi, Hisao (Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Mar 1989. (In Japanese). (CONF-8806441–: 4. IAERU seminar, Tokyo (Japan), 18 Jun 1988). In *Proceedings of IAERU seminar-4.* Order Number DE90705939. Available from NTIS (US Sales Only), PC A07/MF A01.

Neutron radiography (NR) is widely applied especially for non-destructive inspection of industrial products. An outline of NR technique is given in this report with few examples of industrial applications. The quality of a NR image depends on many factors. The values of L, D, and L/D are main factors to define a geometrical unsharpness of NR images. A device for accurate measurements of those parameters is proposed and fabricated. Degree of confidence is estimated for measurements of those parameters in detail. Values of L, D, and L/D are measured for our NR facilities with different geometrical conditions by use of the device and the values are compared to the designed values. The quality of the NR image also depends on an inherent unsharpness of its imaging device. The inherent unsharpness is measured as an edge spread function (ESF) and a modulation transfer function (MTF) is derived from the ESF with a technique of the discrete fast Fourier transform (DFFT). Results are compared to theoretically calculated MTF. (author).

2251 (IAERU–8802, pp. 29-47) **Studies and applications of neutron radiography with film methods.** Ikeda, Yasushi (Nagoya Univ. (Japan). Faculty of Engineering). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Mar 1989. (In Japanese). (CONF-8806441–: 4. IAERU seminar, Tokyo (Japan), 18 Jun 1988). In *Proceedings of IAERU seminar-4.* Order Number DE90705939. Available from NTIS (US Sales Only), PC A07/MF A01.

Neutron radiography has been studied with film methods and applied to some industrial applications. The film methods include not only conventional silver-halide emulsion films, such as industrial, medical or soft X-ray ones, but also track-etch films and those for indirect methods. The characteristics of the film methods are analyzed and investigated with using various image converters, such as gadolinium metal foil and evaporation films, or some scintillation converters such as NE426. The sensitivities and MTFs for various sets of films and converters have been obtained, which gives a chart of the correlation between the appropriate exposure and resolving powers for them. From the chart, one can select some proper sets for the purpose and given conditions of neutron radiography facilities. The film methods have been applied to inspect very fine cracks in thick steel blocks and plates. It is also applied to observe nuclear fuel pellets or irradiated nuclear fuel pins. Furthermore, the film method has been used for neutron computed tomography. Very fine Eu-particles in TiO pellets, which diameters are nearly 300 micron, can be reconstructed by the neutron CT. The fine neutron CT will be useful for the inspection of Pu-particles in mixed oxide nuclear fuel pellets for future advance nuclear reactors. (author).

2252 (IAERU–8802, pp. 49-71) **Digital image processing for real-time neutron radiography and its applications.** Fujine, Shigenori (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Mar 1989. (In Japanese). (CONF-8806441–: 4. IAERU seminar, Tokyo (Japan), 18 Jun 1988). In *Proceedings of IAERU seminar-4.* Order Number DE90705939. Available from NTIS (US Sales Only), PC A07/MF A01.

The present paper describes several digital image processing approaches for the real-time neutron radiography (neutron television-NTV), such as image integration, adaptive smoothing and image enhancement, which have beneficial effects on image improvements, and also describes how to use these techniques for applications. Details invisible in direct images of NTV are able to be revealed by digital image processing, such as reversed image, gray level correction, gray scale transformation, contoured image, subtraction technique, pseudo color display and so on. For real-time application a contouring operation and an averaging approach can also be utilized effectively. (author).

2253 (IAERU–8802, pp. 73-99) **Transportable thermal neutron radiography devices.** Wada, Nobuo (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Mar 1989. (In Japanese). (CONF-8806441–: 4. IAERU seminar, Tokyo (Japan), 18 Jun 1988). In *Proceedings of IAERU seminar-4.* Order Number DE90705939. Available from NTIS (US Sales Only), PC A07/MF A01.

A transportable exposure device equipped with a 1 mg ^{252}Cf neutron source was designed and constructed for thermal neutron radiography. It has three divergent collimators with a large outlet aperture of 200 mm in diameter. These collimators have the same length (L) of 500 mm and an inlet aperture (D) of different sizes.; 10, 20 or 40 mm in diameter. A thermal neutron flux of 3.0×10^3 cm^{-2} s^{-1} was obtained at the outlet of the collimator for L/D ratio of 25. The ratio of thermal neutron to γ-ray dose rate was 2.9×10^4 cm^{-2} mR^{-1} at the same position. It was shown that direct exposure method using the combination of a scintillation converter (NE-426)

and a fine grain film (Kodak-SR) is an appropriate choise for high quality radiographs. Track-etching method using an enriched-^{10}B converter in contact with a nitrocellulose film was also found to show an excellent image resolution in such low flux neutron imaging under high γ-ray background. In this paper, a simple neutron imaging device consisting of an image intensifier and Poraloid camera, neutron and gamma simultaneous neutron radiography technique and neutron induced alpha-ray auto-radiography technique are also described. In addition, fixed or transportable neutron radiography systems using accelerator neutron sources are presented. (author).

2254 (INIS-mf–12013, pp. 51) **Preparation of ^{60}cobalt sources by molecular plating.** Baumann, H. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik); Essig, W.; Hirning, R.; Kayser, J.; Ferber, H.; Grabisch, K.; Shamir, M.; Schuehrer, B.; Wirth, H.L. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

^{60}cobalt layers on thin self-supported carbon foils have been prepared by molecular plating. (orig.).

2255 (PPA-T–83) **Preparation methodology of radiation - curable resin. Unsaturated polyesters.** Dahlan bin Haji Mohd; Hussin bin Mohd Nor; Mohamad Hilmi bin Mahmood. Unit Tenaga Nuklear, Bangi, Selangor (Malaysia). [1989]. 23p. Order Number DE90608596. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Two types of unsaturated polyester have been prepared according to normal alkyd methods of preparation. In this work the emphasis has been given to the preparation methodology of unsaturated polyesters in styrene. Their molecule weight distributions fall between normal alkyd's i.e. 2500 to 3500. (author).

2256 (PPA-T–88) **Electron beam (EB) curing of wood surface finishing - lamination of PVC film on wood substrates. Final report STA scientist exchange program JAERI, Takasaki, Japan (September to November 1988).** Mohamad Hilmi bin Mahmood. Unit Tenaga Nuklear, Bangi, Selangor (Malaysia). Dec 1988. 17p. Order Number DE90608597. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The properties of the films formulated by using various acrylated polyesters and urethane oligomers, mono-, di- and trifunctional monomers cured by using EB machine were investigated. The processability of these formulations on wood substrates were examined and later to apply those few selected formulations as adhesives in the EB curing of lamination of PVC films on wood substrates. (author).

2257 (PPA-T–89) **Non-destructive radiometry inspection technique for locating reinforcements and void/porosity in bridge bearings.** Yahaya bin Jafar; Jaafar bin Abdullah; Mohamad Azmi bin Ismail. Unit Tenaga Nuklear, Bangi, Selangor (Malaysia). [1989]. 29p. Order Number DE90608593. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Defects detection in bridge bearings is very important in controlling quality and safety. Typical manufacturing defects include misalligned or bent steel plates and the presence of voids/porosity within the rubber. A non-destructive radiometry inspection technique was used to locate steel plates position and the presence of voids/porosity in bridge bearing samples provided by the Rubber Research Institute of Malaysia (RRIM). Preliminary studies show that the mentioned defects can readily be determined by this technique. Some of the results are also presented. (author).

08 HYDROGEN

Refer also to citation(s) 2993

0801 Production

2258 (EPRI-GS–6563) **Hydrogen conference: Workshop proceedings.** Serfass, J.; Bugel, L. Electric Power Research Inst., Palo Alto, CA (USA); Technology Transition Corp., Washington, DC (USA). c Oct 1989. 199p. Sponsored by Electric Power Research Institute. (CONF-8811281–: Hydrogen conference, Palo Alto, CA (USA), 16-17 Nov 1988). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This meeting was designed to encourage discussion of today's US industrial, utility, space and environmental interests in hydrogen and tommorrow's use of hydrogen as an energy system. The meeting began with a general session during which speakers gave presentations on a variety of hydrogen topics. Discussion following each presentation was lively. Some of the major points of discussion were: interpretation of global warming evidence; relevance of global warming to the interest in hydrogen; cost of hydrogen derived from fossil fuels vs. nuclear vs. solar; likely future importance of hydrogen – major energy system vs. niche player. A number of interesting points were raised and data presented by speakers and participants. Highlights are presented.

0806 Industrial and Commercial Use

Refer also to citation(s) 2258

0808 Properties

2259 (ORNL/tr–89/42) **Horizontal cold source friction losses of D_2 model with coaxial tubes comparison of calculated values with experimental results in D_2.** Hoffmann, H. Oak Ridge National Lab., TN (USA). 1989. 34p. Translation of Re 972 N(p) 007, July 1983. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002165. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The horizontal cold source will be placed in the available H5 channel and the heat produced will be transported by natural convection from the moderator (deuterium) in a thermosiphon circuit in a saturated state (temperature 25°K). The horizontal cold source cell is supplied by the liquid moderator which partially evaporates in the cell. The vapor produced leaves the cell mixed with liquid deuterium and is liquefied in a condenser. In the case under study, the horizontal cold source cell is connected to the condenser by two tubes placed coaxially in the upper part of the cell. These tubes are mounted horizontally in the channel and behind the protective plug they rise vertically to the condenser. The fluid is single phase when it flows in the center tube towards the cell and it is diphase in the ring-shaped space going towards the condenser. 6 refs., 14 figs., 4 tabs.

0809 Environmental Aspects

Refer also to citation(s) 2258

09 OTHER SYNTHETIC AND NATURAL FUELS

2260 (SAND–89-0917) **Shock-wave characterization of energetic booster-rocket propellant WAK-2 and its simulant UGS.** Weirick, L.J. Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 34p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC04-76DP00789. Order Number DE90002633. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A series of shock-loading experiments on an energetic propellant and its simulant was conducted on a light-gas gun. The purpose of this work was to characterize the shock sensitivity of WAK-2, which is a composite-modified, double-based, booster-rocket propellant and its simulant UGS. The initial objectives were to obtain Hugoniot data, to investigate the pressure threshold at which a reaction occurs, and to measure spall threshold at various impact velocities. The Hugoniot data obtained for the propellant fits the Hugoniot curve provided by the manufacturer of the propellant. A Hugoniot curve developed for the simulant was found to match that of the propellant. The initial density, ρ_0, initial bulk sound velocity, C_0, and constant S values for the energetic propellant WAK-2 and its simulant UGS were 1.85 g/cm^3, 2.2 mm/μs and 2.66, respectively. The ignition threshold pressure of the WAK-2 was found to be in the

range of 3 kbar. A violent reaction was observed for a sample impacted at a pressure of 22 kbar. In spall tests, impact pressures in the range of 1.1 to 3.1 kbar were applied to the propellant/simulant. The propellant exhibited spall strengths ~0.33 kbar, with its simulant being somewhat weaker, ~0.22 kbar. Scanning electron microscopy and electron microprobe analysis were used to characterize the microstructures of the materials and to determine the details of the spall events. 20 refs., 19 figs., 9 tabs.

0901 Hydrocarbon Fuels

Refer also to citation(s) 2028, 2151

2261 (DOE/PC/30021–T20) **Slurry reactor hydrodynamics studies: Final report.** Air Products and Chemicals, Inc., Allentown, PA (USA). 1985. 152p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-80PC30021. Order Number DE90002792. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Air Products has completed a three-year DOE contract in which new slurry phase catalysts (Task 2) and slurry phase bubble column reactor correlations (Task 3) for the Fischer-Tropsch synthesis were developed. This report presents results from the reactor studies. Using both a 12.7 and a 30.5 cm diameter cold flow simulator, phase holdups, phase dispersion coefficients, and interphase heat and mass transfer coefficients were measured and correlated. This information was incorporated into a computer model of a three-phase bubble column. The heat and mass transfer and phase dispersion correlations were found to conform to the literature, while the phase holdup correlations were different. Combining product distributions from the Task 2 catalyst tests with the results of the Task 3 hydrodynamic studies allowed prediction of space-time yields of product fuel fractions in large-scale slurry bubble columns. 106 refs., 37 figs., 27 tabs.

2262 (DOE/PC/30021–T21) **Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 2.** Air Products and Chemicals, Inc., Allentown, PA (USA). [1989]. 54p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-80PC30021. Order Number DE90002793. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The preparation, characterization, and performance of a range of metal catalysts for use in slurry phase Fischer-Tropsch technology was investigated with the objective of developing new compositions with improved selectivity for gasoline and diesel fuel range hydrocarbons. A series of conventional catalysts was identified for testing for both gas and slurry phases. A gas phase screening protocol was set up to allow reasonably rapid determination of each catalyst's synthesis gas conversion characteristic over a range of operating conditions. The catalysts selected represented a range of catalytic metals known to promote conversion of synthesis gas to hydrocarbon liquids. Both precipitates and supported variations of these metals were studied. Catalysts studied include: ruthenium-based catalysts with osmium, and cobalt carbonyl supported on zirconia promoted. 23 refs., 2 figs., 10 tabs.

2263 (DOE/PC/30021–T22) **Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 4.** Air Products and Chemicals, Inc., Allentown, PA (USA). [1989]. 92p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-80PC30021. Order Number DE90002794. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The US Department of Energy contracted with Air Products and Chemicals, Inc. to design a bench-scale bubble column reactor unit for Fischer-Tropsch slurry catalyst operations. The resulting process design includes the reaction, wax withdrawal, and product fractionation sections of a bench scale Fischer-Tropsch reactor. The design of the bench-scale Fischer-Tropsch reactor (BFTR) is based upon reaction rates and product yields measured with the slurry-phase catalysts that Air Products developed and evaluated in Task 2 of this contract and on results of a cold-flow hydrodynamic study of the bubble-column reactor that was conducted under Task 3 of the contract. The goal of Task 4 is to design the reactor and wax withdrawal portions of the reactor and estimate total cost of the system. 5 refs., 2 figs., 17 tabs.

2264 (DOE/PC/90014–T2) **Upgrading of light Fischer-Tropsch products: Quarterly report No. 6, January 1, 1988–March 31, 1988.** UOP, Inc., Des Plaines, IL (USA). 11 Jul 1989. 113p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86PC90014. Order Number DE90003033. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Work during this quarter concentrated on Task 4 of the study. The objective of this task is to evaluate the applications of the UOP/BP Cyclar process to the upgrading of Fischer-Tropsch LPG products into aromatics. Task 4.0 is divided into three major subtasks: 4.1 – Huels CSP Study; 4.2 – Indirect Cyclar Processing; and 4.3 – Direct Cyclar Processing. In the Direct Cyclar route, Fischer-Tropsch LPG is fed directly to the Cyclar unit. In the Indirect route, the LPG is first processed by Huels CSP to reduce the olefin content and then sent to the Cyclar unit. This quarterly report covers all Cyclar pilot plant results conducted within this contract (subtasks 4.1 and 4.2). The yield distribution of xylenes, toluene, and benzene is discussed along with catalyst stability and activity. 45 figs., 7 tabs.

2265 (DOE/PC/90014–T3) **Upgrading of light Fischer-Tropsch products: Quarterly report No. 7, April 1, 1988–June 30, 1988.** UOP, Inc., Des Plaines, IL (USA). 11 Jul 1989. 39p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86PC90014. Order Number DE90003032. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Work during this quarter concentrated on Task 4 of the study. The objective of this task is to evaluate the application of the UOP/BP Cyclar® process to the upgrading of Fischer-Tropsch LPG products into aromatics. Results from pilot plant studies conducted within Task 4 were translated into commercial yield estimates. This quarterly report describes the translation process, and documents the results. 3 refs., 12 figs., 20 tabs.

2266 (NEI-DK–217) **Two-step process for conversion of lignocellulose into methane.** Richards, S.R.; Spendler, F.H. Teknologisk Inst., Taastrup (Denmark). Bioteknik. Jul 1989. 105p. Order Number DE90719033. Available from NTIS (US Sales Only), PC A06/MF A01.

EFP-86; EFP-87. In cooporation with BIOTAL Ltd., Llanishen, Cardiff (GB).

On-field burning of straw becoming prohibited throughout the EEC. Straw can represent a large potential source of energy for the production of biogas (methane) by anaerobic digestion but the lignocellolosic nature of the straw means that digestion is slow and yields may be poor. This study aims to examine the potential for a biological pretreatment using white-rot fungi to enhance the digestibility of barley straw, and to optimise the subsequent anaerobic digestion of partially delignified material. Among a wide range of white-rot fungi tested, PLEUROTUS OSTREATUS strains selectively delignify barly straw and produced a cellulose-rich straw. This cellulose-rich straw more than doubled the yield of reducing sugars during a cellulase digestion, and increased the methane yield by 22% more compared with untreated straw. However, when the dry matter lossed in the pretreatment are included in the estimations, there is no net increase in methane yield compared to untreated straw. As expected the methane yield increased with retention times when straw is digested in continously-fed digesters. Loading rates higher than 1.25 g straw/l digester/day resulted in a rapid drop in pH and inhibition of methanogenesis. Straw pretreated with PLEUROTUS OSTREATUS strains and digested in continously-fed reactors gave the similar results as batch-fed digestion. During anaerobic digestion hemicellulose was hydrolysed to the same extent over the range of retention times studied (10 to 47.5 days) whereas cellulose hydrolysis increased with increasing retention time. Chemical pretreatment of straw was found to be a more efficient method than biological pretreatment. Sodium hydroxide, mild acid and alkaline perioxide pretreatment increased the biogas yield between 15 and 160%. (AB).

2267 (PB–89-230643/XAB) **Photoconversion of inorganics to methane. Final topical report, October 1987-February 1989.** Copeland, R.J.; Feinberg, D.; Karpuk, M.; Wright, J. TDA Research, Inc., Wheat Ridge, CO (USA). May 1989. 70p. (TDA–89-GRI-002). Available from NTIS, PC A04/MF A01.

This report evaluates the cost of producing gaseous fuels from carbon dioxide, water, and solar energy. Such a process must have

high conversion efficiency and low capital costs per unit of collection area to be economically attractive. A novel pond reactor is designed that has a cost much lower than other conversion facilities but still higher than is needed to produce economically competitive fuels at projected efficiencies. Due to a change in supply strategy away from long-term synthetic routes to gaseous fuels, GRI has redirected this contract to evaluate other inorganic-chemistry-related projects.

2268 (PB–89-232615/XAB) **Biological and biochemical methane reactions. Final report, March 1986-March 1989.** Dalton, H.; Pienkos, P.T.; Stirling, D.I. Celgene Corp., Warren, NJ (USA). Apr 1989. 50p. Available from NTIS, PC A03/MF A01.

See also PB–88-232764.

The purpose of this project was to characterize the nature of the active site involved in methane activation by enzymes from well characterized and newly isolated methane-oxidizing bacteria. Kinetic and structural studies provided an initial picture of how the soluble methane monooxygenase (MMO) enzyme is structured and operates to selectively oxidize methane to methanol under ambient conditions. Cloning and sequencing of genes coding for some of the sMMO proteins were completed, and 72 strains of methanotrophs were isolated from extreme environments.

0902 Alcohol Fuels

Refer also to citation(s) 2142, 2800

2269 (ANL/CNSV–69) **Biocrude suitability for petroleum refineries.** Schmalzer, D.K.; Gaines, L.L.; Herzenberg, C.L.; Snider, M.A. Argonne National Lab., IL (USA). Jun 1988. 91p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. Order Number DE90002619. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Technologies are now being developed that could produce crude oil from biomass, making available an alternative fuel source as petroleum supplies dwindle and prices rise. If the existing infrastructure for transporting and refining petroleum could be used for biocrude, the transition from petroleum would be smoother and less costly. This report examines the suitability of the existing systems for transporting biocrude and processing it into gasoline. Available biomass production areas were identified and potential production was estimated. Production areas with the potential to supply conversion plants were then matched with transportation paths and refinery locations to minimize transportation costs. Technical requirements for treating biocrude were examined, based on its expected chemical composition and physical properties, and compared to existing refinery equipment and capacity. Environmental constraints were taken into account at each step. Although biomass-derived oils could be transported to refineries the existing refinery equipment is not optimal for upgrading these oils to a gasoline-grade product. Furthermore, existing hydrogen production capacity is grossly inadequate for upgrading substantial volumes of biocrude. Partial or total upgrading at conversion facilities or regional upgrading facilities is discussed briefly, but in-depth evaluation of such options is beyond the scope of this study. 82 refs., 26 figs., 35 tabs.

2270 (ETDE-mf–0721936) **Investigation of the formation and chemical aspects of coke deposits occurring on acid, monofunctional zeolite catalysts through typical reactions with hydrocarbons.** Karge, H.G. Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin (Germany, F.R.). 1987. 17p. (In German). Contract BMFT 03C 231 1. Order Number DE90721936. Available from NTIS (US Sales Only), PC A03/MF A01.

Zeolite catalysts of the firm DEGUSSA were characterized with physico-chemical methods. For the determination of the 'acidity' (nature, density and stability of the acid centres), the IR spectroscopy with and without probe molecules as well as the temperature-programmed desorption of ammonia (NH_3-TPD) were used. The transmission UV/VIS spectroscopy made it possible to observe the preceding stages of the coke formation under the influence of methanol in dependence on the reaction temperature. These results were compared with those of the ethylene reaction. The spectra of the working catalysts and the obtained conversions on the preparation in the IR cell were measured at the same time by in-situ IR measurements. (orig./RB).

2271 **Development of the foundation for direct conversion of methane to methanol.** Finch, F.T.; Baughcum, S.L.; Beattie, W.H.; Danen, W.C.; Ferris, M.J.; Lyman, J.L.; Odlenborg, R.C.; Rofer, C.K.; Streit, G.E. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 166E.

Methanol is currently produced from methane by the catalytic oxidation of methane to synthesis gas, followed by catalytic methanol synthesis. A single-step partial oxidation of methane to methanol would be highly desirable, if the reaction kinetics could be controlled. Using such an approach, the authors have experimentally achieved 70% conversion selectively to methanol at low yield, and have developed a predictive free-radical chemical kinetics model based on fundamental measurements. This model is described in this paper. Oxidation of methane with slightly substoichiometric to stoichiometric concentrations of oxygen at pressures greater than 50 atm and temperatures in the range of 800-1000 K is predicted to give attractive yields of methanol when the free-radical populations can be controlled and the reaction can be optimally terminated.

0904 Solid Waste and Wood Fuels

Refer also to citation(s) 3115

2272 (NEI-DK–212) **Flue gas condensation in stoking system for wood chips.** Evald, A. Skovteknisk Inst., Copenhagen (Denmark). Jan 1988. 22p. (In Danish). Order Number DE90718977. Available from NTIS (US Sales Only), PC A03/MF A01.

The text is based on a study of relevant literature and is concerned with the condensation of flue gas from wood-chip fuelled plants. As wood-chips have a heavy water content there is a considerable energy potential in the steam resulting from the combustion of this fuel, which has a much lower content of noxious gases than other emissions. The content of pollutive substances is analized, and the method of condensation is described. Possibilities for energy saving and reduction of environmental pollution involved in the utilization of this process are briefly discussed. (AB) 23 refs.

2273 (PB–89-230510/XAB) **Fuel-supply structure of wood-fired power plants in the Northeast: Loggers' perspective. Forest Service research paper.** Huyler, N.K. Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station. Jul 1989. 26p. (FSRP-NE–624). Available from NTIS, PC A03/MF A01.

This study gauges loggers' perceptions of the impact of large biomass demand centers (electrical power generation) on the forest resource base in the Northeast. The loggers who supply these demand centers are business people with large capital investments in highly mechanized harvesting systems. Most of the loggers surveyed strongly believed that the post-harvest stand has improved as a result of fuel-wood chipping; however, the impact of chip harvesting on the forest resource base was not clear.

2274 (SLU-ISK–179) **Handling characteristics of wood fuels - angle of repose for different assortments.** Mattsson, J.E. Swedish Univ. of Agricultural Sciences, Garpenberg (Sweden). Dept. of Operational Efficiency. Mar 1989. 55p. (In Swedish). Order Number DE90719393. Available from NTIS (US Sales Only), PC A04/MF A01.

Most operational problems in energy plants using wood fuels are related to storage and internal transport of the fuel. Sometimes expensive reconstruction has been necessary. These problems depend to a great extent on insufficient knowledge of basic handling characteristics of wood fuels. Therefore, the angle of repose, friction against different surfaces, freezing behaviour and tendency of bridging are studied for different wood fuels. The study aims at finding relations between the angle of repose and particle shape, size distribution and moisture content. The angle of repose was found to vary between 25 and 55 degrees. It was much lower, 25-30 degs, for dry chunkwood from delimbed birch with a particle length of 180 mm, than for other wood fuels, that had 35-55 degs. The particle shape and moisture content had a significant influence on the angle of repose. Particle size (particle length) had no significant influence on the angle of repose. (With 19 figs., 5 tables).

2275 (STU–86-4162) **Separation of wood chips for energy production.** Westermark, M. Swedish National Board for Technical Development, Stockholm (Sweden). 15 Aug 1988. 79p. (In Swedish). Order Number DE90719415. Available from NTIS (US Sales Only), PC A05.

App. 3 illegible.

A literature and patent study gave the following results. If separation of compression wood chips is done before pulp manufacture it should be possible to obtain lower consumption of chemicals for cooking and bleaching, better strength properties of the pulp, and a decreased formation of organic chlorine compounds in the pulp in bleachplant waste water. The separated compression wood chips is suitable to be used for energy production. The separation can be done by density separation or stratification. Density separation is done by airing the water with tiny bubbles, the air-water mixture obtaining a density of c. 600 kg/m^3. The lighter normal wood then rises to the surface whereas the compression wood sinks. (author).

13 HYDRO ENERGY

1301 Resources and Availability

2276 (ETSU-SSH–4063-P1) **Small scale hydroelectric generation potential in the UK. V. 1.** Department of Energy, London (UK); UKAEA Harwell Lab. (UK). Energy Technology Div. 1989. 152p. Order Number DE90722760. Available from NTIS (US Sales Only), PC A08.

This study, commissioned by the Energy Technology Support Unit for the Department of Energy, undertakes the first comprehensive assessment of the economic potential for small-scale hydro-electric generation throughout the UK. Whilst small hydro technology is well understood, and many sites appear economic initially, there is little evidence of actual deployment of the technology. Accordingly, consideration has been given to factors affecting development, including land ownership, Water Authority abstraction charges, Local Authority rates, energy usage and environmental considerations. The scope of the study extended to both run-of-river sites and sites within the Water Industry in the UK, with installed capacities in the range 25kW to 5MW. (author).

1303 Plant Design and Operation

2277 (EGG-M–89101) **Siphon penstock installations at hydroelectric projects: A survey of design, construction and operating experience.** Burgoine, D.; Rodrigue, P.; Tarbell, J.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-82ID12356. (CONF-890876–3: Waterpower '89: international conference on hydropower, Buffalo, NY (USA), 23-25 Aug 1989). Order Number DE90001749. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There can be advantages to using siphon penstocks at small hydro projects, particularly those constructed at existing dams. One problem, however, is a lack of documentation of siphon penstock installations. The design considerations, construction and operating aspects of siphon penstock installations are described here. 4 figs., 1 tab.

1305 Economics and Management

Refer also to citation(s) 2282, 2283, 2284, 2285, 2286

1306 Environmental Aspects

2278 (DOE/BP/12659–5) **Quantification of Hungry Horse Reservoir water level needed to maintain or enhance reservoir fisheries: Methods and data summary, 1983–1987.** May, B.; Glutting, S.; Weaver, T.; Michael, G.; Morgan, B.; Suek, P.; Wachsmuth, J.; Weichler, C. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Montana Dept. of Fish, Wildlife and Parks, Kalispell, MT (USA). Jun 1988. 148p. Sponsored by U.S. DOE Bonneville Power Administration; U.S. DOE Management & Administration. DOE Contract AI79-83BP12659. Order Number DE90002772. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The Hungry Horse Reservoir study is part of the Northwest Power Planning Council's resident fish and wildlife plan. The plan is responsible for mitigating damages to the fish and wildlife resources caused by hydroelectric development in the Columbia River Basin. The major goal of our study is to quantify seasonal water levels needed to maintain or enhance the reservoir fishery. This study began in May, 1983, and the initial phase will be completed July, 1988. This report summarizes limnological, fish abundance, fish distribution and fish food habits data collected from 1983 to 1988. The effect of reservoir operation upon fish habitat, fish food organisms and fish growth is discussed. 71 refs., 36 figs., 46 tabs.

2279 (DOE/BP/35245–2) **Assessment of smolt condition for travel time analysis: Annual report 1988.** Rondorf, D.W.; Beeman, J.W.; Faler, J.C.; Free, M.E.; Wagner, E.J. Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center. Mar 1989. 115p. Sponsored by U.S. DOE Management & Administration. DOE Contract AI79-87BP35245. Order Number DE90002782. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Estimates of migration rates and travel times of juvenile salmonids within index reaches of the Columbia River basin are collected through the Smolt Monitoring Program for use by the Fish Passage Center. With increased reliance upon travel time estimates in 1988 by the Fish Passage Center, this study was implemented to monitor the biological attributes of juvenile chinook salmon Oncorhynchus tshawytscha and steelhead trout O. mykiss used for the travel time estimates. The physiological ability of fish to respond to stress was assessed by measuring levels of plasma cortisol, glucose, and chloride before and after a stress-challenge test. The development of smoltification was evaluated by measuring gill Na^+K^+-ATPase, plasma thyroxine, purines, and body morphology. Most groups were similar at the hatcheries but differed as the migration to McNary Dam proceeded. The prevalence of bacterial kidney disease (BKD) in spring chinook salmon was evaluated using the enzyme linked immunosorbent assay (ELISA) and fluorescent antibody technique (FAT). Prevalence of BKD in groups tested using the ELISA method was as high as 99% at some downstream locations. A review of indices is presented as a guide to the development of an index of smolt condition and preliminary data are presented. An index could be used as a tool to synthesize information on fish condition to assist with management and evaluation of the Water Budget.

2280 (DOE/BP/39643–3) **Use of a fish transportation barge for increasing returns of steelhead imprinted for homing: Final report.** Harmon, J.R.; Slatick, E. National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div. Aug 1989. 134p. Sponsored by U.S. DOE Management & Administration. DOE Contract AI79-83BP39643. Order Number DE90002783. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The objective of this 7-year National Fisheries Service study, which began is 1982, was to determine if transporting juvenile steelhead (Oncorhynchus mykiss) by truck and barge from Dworshak National Fish Hatchery (NFH), on the Clearwater River, to a release site on the Columbia River below Bonneville Dam would result in increased returns of adults to the various fisheries and to the hatchery homing site. During 1982 and 1983, over 500,000 marked juvenile steelhead were serially released as controls from the hatchery or barged as test fish to below Bonneville Dam. Recoveries of marked adults to various recovery sites are complete. Fish released in 1983 showed a stronger homing ability and more rapid upstream migration than test fish released in 1982. Most adults from both control and test releases in 1983 and control releases in 1982 migrated a considerable distance upstream and overwintered in the Snake and Clearwater Rivers–behavior similar to Clearwater River fish previously transported from Lower Granite Dam. In contrast, many of the adults from test releases in 1982 failed to migrate upstream during the fall, overwintered in the Columbia River, and migrated upstream the following spring. Survival of control fish released at Dworshak NFH in late April 1982 was substantially higher than survival of those released in mid-May. Survival and homing of control fish released in late April and early May 1983 were over 10 times that for

fish released in late May. Return of adults from normal hatchery releases in 1982 was the highest ever observed at Dworshak NFH.

2281 (DOE/BP/65903–2) **State of Idaho augmented anadromous fish health monitoring: Annual report, FY 1988.** Foott, J.S.; Hauck, A.K. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Idaho Dept. of Fish and Game, Eagle, ID (USA). Eagle Fish Health Lab. Sep 1989. 51p. Sponsored by U.S. DOE Bonneville Power Administration; U.S. DOE Management & Administration. DOE Contract AI79-87BP65903. Order Number DE90002781. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report documents the progress in the assigned tasks which have occurred during the second year of the Augmented Anadromous Fish Health Monitoring Project. Fish at seven Idaho Department of Fish and Game facilities were monitored for various pathogens and organosomatic analyses were performed on smolts prior to their release in the spring of 1989. A disease database has been developed and facility impediments to fish health have been identified. 12 refs., 14 tabs.

2282 (PB–89-224125/XAB) **Jubba Environmental and Socio-economic Studies (JESS). Final report.** Associates in Rural Development, Inc., Burlington, VT (USA). 1989. 1431p. Available from NTIS, PC EE99/MF E99.

Set includes PB–89-224133 through PB–89-224166.

A separate abstract was prepared for each of the four volumes of this set.

2283 (PB–89-224133/XAB) **Jubba Environmental and Socio-economic Studies (JESS). Volume 1. Executive report. Final report.** Associates in Rural Development, Inc., Burlington, VT (USA). 1989. 141p. Available from NTIS, PC A07/MF A01.

See also Volume 2, PB–89-224141; Also available in set of 4 reports PC E99, PB–89-224125.

Jubba Environmental and Socio-economic Studies (JESS) was carried out as a three-phase project to collect environmental and socio-economic data in Somalia's Jubba Valley, the site of proposed development of a large hydroelectric dam. Complementary to construction of the dam, various plans are being prepared for subsequent development of irrigated agriculture in the middle and lower Jubba Valley. Numerous environmental and socio-economic changes will occur with dam construction, filling of the reservoir, infrastructural enhancement, and intensification of agriculture. Volume I, the Executive Report, and reports based on JESS longer-term studies (TEBS and SEBS) represent the most comprehensive assessment of the overall JESS effort: these reports consider and, in most cases, summarize the findings of other investigations.

2284 (PB–89-224141/XAB) **Jubba Environmental and Socio-economic Studies (JESS). Volume 2. Environmental studies. Final report.** Associates in Rural Development, Inc., Burlington, VT (USA). 1989. 671p. Available from NTIS, PC A99/MF A01.

See also Volume 1, PB–89-224133 and Volume 3, PB–89-224158.; Also available in set of 4 reports PC E99, PB–89-224125.

The Jubba Environmental and Socio-economic Studies (JESS) investigated conditions in the Jubba Valley of southern Somalia. Projections from that baseline information were intended to elucidate changes likely to occur as a result of construction of a high dam near Baardheere and related developments. In particular, JESS was required to suggest ways of mitigating adverse impacts, enhancing potentially good impacts, and to draw up a program for future environmental and socio-economic monitoring. The report contains an analysis of the Terrestrial Ecology Baseline Studies (TEBS) section of the JESS project. Human use of biological resources is examined from the perspectives of land use, forestry, rangelands, and biological conservation. TEBS activities are used as the basis for a future monitoring program of terrestrial ecology.

2285 (PB–89-224158/XAB) **Jubba Environmental and Socio-economic Studies (JESS). Volume 3. Socio-economic studies. Final report.** Associates in Rural Development, Inc., Burlington, VT (USA). 1989. 497p. Available from NTIS, PC A21/MF A01.

See also Volume 2, PB–89-224141 and Volume 4, PB–89-224166; Also available in set of 4 reports PC E99, PB–89-224125.

The Government of the Somali Democratic Republic (GSDR), with the support of the international donor community, is prepared to launch a comprehensive program for the development of Jubba Valley. The keystone of the program is construction of a dam on the Jubba River near Baardheere. Planners have been looking toward construction of the dam, among other things, to increase agricultural output by fostering irrigation development. The objectives of the Socio-economic Baseline Study (SEBS) report are to: present a body of a new information on socio-economic life in Jubba Valley; assess the impact of development efforts on socio-economic life; recommend measures to enhance beneficial impacts and mitigate adverse ones; and propose a program to monitor the progress of those impacts and interventions.

2286 (PB–89-224166/XAB) **Jubba Environmental and Socio-economic Studies (JESS). Volume 4. Bibliography. Final report.** Associates in Rural Development, Inc., Burlington, VT (USA). 1989. 122p. Available from NTIS, PC A06/MF A01.

See also Volume 3, PB–89-224158; Also available in set of 4 reports, PC E99, PB–89-224125.

This bibliography is a revised version of the Jubba Environmental and Socio-economic Study (JESS) bibliography that was published in 1986, relating specifically to social and environmental systems in Somalia as well as river-basin assessment and planning, in general. Many new references have been added and the bibliography has been organized into 22 different sections, corresponding to the subject codes (BIBCODE) being used by the JESS team in Somalia. The bibliography includes selected monographs, conference papers, journal articles, book chapters, reports, JESS studies and dissertations. Users should recognize that the bibliography is neither definitive nor comprehensive, and that an inclusion of a particular reference does not imply that its scientific merit has been substantiated.

2287 (VTT-TIED–986) **Ecological aspects of lake regulation in Northern Finland. Part 2. Geomorphology and vegetation of the littoral zone.** Hellsten, S.; Alasaarela, E.; Keraenen, R.; Nykaenen, M.; Neuvonen, I. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. 148p. (In Finnish). Order Number DE90719338. Available from NTIS (US Sales Only), PC A07/MF A01.

Ecological aspects of lake regulation were studied in certain lakes in northern Finland in 1984-1987. The general aims of the project were to analyze the effects of regulation on lake ecosystems and to produce information that can be applied when assessing the possible effects of hydroelectric projects. The effects of lake regulation were easy to observe in the littoral zone of Lake Ontojaervi, the sandy shores in particular were unstable both above and below the water level. The shores were very much steeper than those of Lake Lentua, which affected the distribution of bottom types, minerogenic bottoms were more common than in the latter lake. The results from the two lakes were used to calculate a simple model to forecast the distribution of bottom types of Lake Ontojaervi before regulation. The effect of penetration by ice was also easy to recognize on the shores of Lake Ontojaervi; the surface sediment being frozen to a greater depth than in Lake Lentua. Beneath the freezing zone in ice just pressed down on the sediment. The littoral vegetation decreased markedly after regulation and was entirely absent in open places. Changes in abundance were particularly clear, with decreases in the large isoetides and helophytes and increases of small isoetides. The results from Lake Lentua were used to formulate a simple ecological model for the frequency of macrophytes.

2288 (VTT-TIED–987) **Ecological aspects of lake regulation in northern Finland. Part 3. Macrozoobenthos and feeding of fish.** Tikkanen, P.; Hellsten, S.; Alasaarela, E.; Kantola, L.; Niva, T. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. 114p. (In Finnish). Order Number DE90719339. Available from NTIS (US Sales Only), PC A06/MF A01.

Ecological aspects of lake regulation were studied in certain lakes in northern Finland in 1984-1987. The general aims of the project were to analyze the effects of regulation on lake ecosystems and to produce information that can be applied when assessing the possible effects of hydroelectric projects. The abundances of benthic animals were 2-3 times higher in the unregulated Lake Lentua than in the regulated Lake Ontojaervi depending on the year, although they were greater on the till shores than on the sandy shores with

both cases. There were also differences in the dominance of certain animal groups and in the diversity of the communities. The number of benthic animals differ in lakes with contrasting regulation procedures, as observed in the present data and in previously published material. In the Lake Nuasjaervi for example, where the summertime mid-water level has been raised only slightly, the abundance and the composition of the fauna resembled the figures for an unregulated lake. Previously published suggest that the abundance of benthic animals (averaged over several years and several habitats) varies in the range 0.5-5 mg/m^2 in regulated lakes and 1-8 mg/m^2 in unregulated lakes.The reduction in the abundance of benthic animals caused by freezing and drying was also seen in the feeding of fish in the early summer, when the stomach fullness values of the white-fish and more especially those of the perch, were notably higher in Lake Lentua than in Lake Ontojaervi.

2289 (VTT-TIED–988) **Ecological aspects of lake regulation in northern Finland. Part 4. Spawning and the survival of the young fish.** Huusko, A.; Sutela, T.; Karjalainen, J.; Hellsten, S.; Hirvonen, A. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. 99p. (In Finnish). Order Number DE90719340. Available from NTIS (US Sales Only), PC A05/MF A01.

Report of the project ECOREGU.

The ecological aspects of lake regulation were studied in certain lakes in Northern Finland in 1984-1987. The aims of the project were to produce information that can be applied, when assessing possible effects of hydroelectric projects. The impacts of water level regulation on the eggs and larvae of both autumn and spring spawning fish were studied by comparing the survival of eggs and larvae, larval densities and the food, feeding and growth of larvae in two neighbouring lakes, in Lake Ontojaervi, regulated with an amplitude of 4.4 m, and Lake Lentua, which remains in a natural state. Survival of eggs of the autumn spawning fish was minimal in the regulation zone of Lake Ontojaervi, while in Lake Lentua and outside the regulation zone in Lake Ontojaervi the chemical properties of the bottom sediment were the most important factors affecting the survival of the eggs in different depth zones. The number and dispersal of the larvae of the vendace, the main autumn spawning fish, varied markedly in the two lakes. The most probable causes of the differences in larval densities were the destruction of the eggs in the regulation zone during the winter and a change in the behaviour and feeding conditions of larvae in Lake Ontojaervi. The density of spring spawning fish was lower in Lake Ontojaervi than in Lake Lentua, one possible reason for this being the diminution of the spawning areas in spring due to the low water level.

2290 (VTT-TIED–989) **Ecological aspects of lake regulation in Northern Finland. Part 5. Regulation practices and ecological effects.** Alasaarela, E.; Hellsten, S.; Tikkanen, P.; Huusko, A. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. 53p. (In Finnish). Order Number DE90719341. Available from NTIS (US Sales Only), PC A04/MF A01.

Report of the project ECOREGU.

Ecological aspects of lake regulation were studied in certain lakes in northern Finland in 1984-1987. The general aims of the project were to analyze the effects of regulation on lake ecosystems and to produce information that can be applied when assessing the possible effects of hydroelectric projects on other forms of utilization of the lakes concerned and when looking for alleviating the adverse effects. In order to maintain an ecological balance in reulated lakes in northern Finland it is important that: The lake water level is not raised so far above the highest natural water level that it will initiate any marked geomorphological processes in the littoral zone. The drop in lake water level during the midwinter should not expose the main part of the productive zone. The effects of a rise water level caused by regulation are greater in large oligotrophic lakes than in small eutrophic lakes. The resulting changes in geomorphological processes will reshape the shores within a few years. If the summer water level is raised, ecological adaptation will be accellerated, which will reduce the amount of water vegetation. This will have a great influence on the landscape and on the food resources and spawing areas of fish. Freezing of the bottom sediment in the littoral zone is a much greater ecological distrubance factor than the weight of the ice. It is easy to reduce the area of frozen sediment by reducing the drop in water level early in the winter. The new important limit will then be the lowest midwinter water level, which will be of greater ecological importance than lowest level reached during the late winter. This limit can be calculated provided that the colour of the water (amount of humic substances) is known.

14 SOLAR ENERGY

Refer also to citation(s) 2612

1401 Resources and Availability

Refer also to citation(s) 2326

2291 (ETDE-mf–0717862) **Estimation of aerosol absorption from measurements of intensity and polarization of the sky radiation at Tsumeb (Namibia). Final report.** Quenzel, H.; Thomalla, E.; Tamm, E. Muenchen Univ. (Germany, F.R.). Meteorologisches Inst. Apr 1988. 45p. (In German). DFG Qu 28/21-1. Order Number DE90717862. Available from NTIS (US Sales Only), PC A03/MF A01.

Measured data of the sky radiation polarization from a radiation measurement campaign in Tsumeb (Namibia) in the year 1971 were used for the determination of the aerosol absorption. The aim of this measurement campaign was to determine all directly measurable parameters for the aerosol properties and the radiation properties of the atmosphere. By means of the results of the measurement campaign, model calculations for the celestial polarization for different values of the imaginary part of the refractive index are carried out. The imaginary part is then determined by the comparison between measurement/calculation. This method is dealt with and discussed in detail by means of the evaluation of the exemplary measurement days. The thus determined absorption proportion is much higher than bibliographical data for aerosol in rural areas; bush fires as a source of soot as well as dark soil samples explain the higher absorption proportion. The data of this measurement campaign are still too uncertain in specific points to make reliable statements. With an improved measurement technique, however, it is possible to use the method in future measurement campaigns. (orig.).

2292 (N–89-27623) **Solar radiation on Mars.** Appelbaum, J.; Flood, D.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Aug 1989. 33p. (NASA-TM–102299;E–4865;NAS–1.15:102299). Available from NTIS, PC A03/MF A01.

Detailed information on solar radiation characteristics on Mars are necessary for effective design of future planned solar energy systems operating on the surface of Mars. Presented here is a procedure and solar radiation related data from which the diurnally, hourly and daily variation of the global, direct beam and diffuse insolation on Mars are calculated. The radiation data are based on measured optical depth of the Martian atmosphere derived from images taken of the sun with a special diode on the Viking cameras; and computation based on multiple wavelength and multiple scattering of the solar radiation.

1403 Economics

Refer also to citation(s) 2322

1404 Environmental, Legal, and Institutional Aspects

Refer also to citation(s) 2316

1405 Solar Energy Conversion

Refer also to citation(s) 2267, 2322, 2760

2293 (ETDE-mf–0722258) **Photovoltaic energy conversion - research projects on solar energy use.** BMFT - Pressereferat. Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 23 Nov 1988. 51p. (In German). Order Number

DE90722258. Available from NTIS (US Sales Only), PC A04/MF A01.

The report reviews the development of photovoltaic energy conversion and the past and present BMFT-funded research in this field, most of which is orientated towards immediate applicability. There is a trend in the direction of marketable products for solar energy use. The report lists invitations for tender in the field of photovoltaic applications, addresses to contact, and the currently sponsored research projects, including names of companies and institutions. (ORU).

2294 (JAERI-M–89-085) **Radiation resistance of solar cells for space application, 1. Study on the irradiation procedure of electron beams.** Mitsui, Hiroshi; Tanaka, Ryuichi; Sunaga, Hiromi and others. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 172p. (In Japanese). Order Number DE90719546. Available from NTIS (US Sales Only), PC A08/MF A01.

A 50-μm thick ultrathin silicon solar cell and a 280-μm thick high performance AlGaAs/GaAs solar cell with high radiation resistance have been recently developed by National Space Development Agency of Japan (NASDA). In order to study the radiation resistance of these cells, a joint research was carried out between Japan Atomic Energy Research Institute (JAERI) and NASDA from 1984 through 1987. In this research, the irradiation method of electron beams, the effects of the irradiation conditions on the deterioration of solar cells by electron beams, and the annealing effects of the radiation damage in solar cells were investigated. This paper is the first one of a series of reports of the joint research. In this paper, the space radiation environment which artificial satellites will encounter, the solar cells used, and the experimental methods are described. In addition to these, the results of the study on the irradiation procedure of electron beams are reported. In the study of the irradiation method of electron beams, three methods, that is, the fixed irradiation method, the moving irradiation method, and the spot irradiation method were examined. In the fixed irradiation method and moving one, stationary solar cells and solar cells moving by conveyer were irradiated by scanning electron beams, respectively. On the other hand, in the spot irradiation method, stationary solar cells were irradiated by non-scanning steady electron beams. It was concluded that the fixed irradiation method was the most proper method. In addition to this, in this study, some pieces of information were obtained with respect to the changes in the electrical characteristics of solar cells caused by the irradiation of electron beams. (author) 52 refs.

2295 (N–89-27619) **Lunar production of solar cells.** Landis, G.A.; Perino, M.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. May 1989. 18p. (NASA-TM–102102;E–4866;NAS–1.15:102102;CONF-8905228–: 9. biennial SSI/Princeton conference on space manufacturing, Princeton, NJ (USA), 10 May 1989). Available from NTIS, PC A03/MF A01.

The feasibility of manufacturing solar cells on the moon for spacecraft applications is examined. Because of the much lower escape velocity, there is a great advantage in lunar manufacture of solar cells compared to Earth manufacture. Silicon is abundant on the moon, and new refining methods allow it to be reduced and purified without extensive reliance on materials unavailable on the moon. Silicon and amorphous silicon solar cells could be manufactured on the moon for use in space. Concepts for the production of a baseline amorphous silicon cell are discussed, and specific power levels are calculated for cells designed for both lunar and Earth manufacture.

2296 (N–89-27705) **NASA advanced space photovoltaic technology-status, potential and future mission applications.** Flood, D.J.; Piszczor, M. Jr.; Stella, P.M.; Bennett, G.L. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 8p. (NASA-TM–102093;E–4856;NAS–1.15:102093;CONF-8910243–: European space power conference, Madrid (Spain), 2-6 Oct 1989). Available from NTIS, PC A02/MF A01.

The NASA program in space photovoltaic research and development encompasses a wide range of emerging options for future space power systems, and includes both cell and array technology development. The long range goals are to develop technology capable of achieving 300 W/kg for planar arrays, and 300 W/sq m for concentrator arrays. InP and GaAs planar and concentrator cell technologies are under investigation for their potential high efficiency and good radiation resistance. The Advanced Photovoltaic Solar Array (APSA) program is a near term effort aimed at demonstrating 130 W/kg beginning of life specific power using thin (62 micrometer) silicon cells. It is intended to be technology transparent to future high efficiency cells and provides the baseline for development of the 300 W/kg array.

2297 (NEI-DK–210) **Development of a container for pumps, measuring equipment and motorgenerators in connection with a bioconversion energy system.** Moeller, E. Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark). May 1989. 47p. (In Danish). Order Number DE90718968. Available from NTIS (US Sales Only), PC A03/MF A01.

This project, financed by the Council of Technology in Denmark, is concerned with the design of a container for pumps, measuring instruments and motor generators in connection with heating systems based on bioconversion for use on farms. Housing this form of equipment has often posed a problem as it could necessitate the construction of new buildings involving extra cost. The container and its functioning is briefly described and a number of detailed engineering drawings are presented. (AB) 6 maps.

2298 (PB–89-226799/XAB) **Microcomputer Scientific Software Series 5: The Biomass User's Manual. Forest Service general technical report.** Host, G.E.; Westin, S.C.; Cole, W.G.; Pregitzer, K.S. Forest Service, St. Paul, MN (USA). North Central Forest Experiment Station. 1989. 14p. (FSGTR-NC–127). Available from NTIS, PC A03/MF A01.

See also PB–83-263640.

BIOMASS is an interactive microcomputer program that uses allometric regression equations to calculate aboveground biomass of common tree species of the Lake States. The equations are species-specific and most use both diameter and height as independent variables. The program accommodates fixed area and variable-radius sample designs and produces both individual tree and areal estimates of whole-tree oven-dry weights.

2299 (PB–89-230189/XAB) **Geographic variation in red alder. Forest Service research paper.** Lester, D.T.; DeBell, D.S. Forest Service, Portland, OR (USA). Pacific Northwest Research Station. Apr 1989. 13p. (FSRP-PNW–409). Available from NTIS, PC A03/MF A01.

A test of 10 provenances was established in 1969 on the central coast of Oregon. The provenances tested included Juneau, Alaska, and Sandpoint, Idaho, in addition to eight well-spaced locations in Oregon, Washington, and in the southern end of Vancouver island, British Columbia. Periodic measurements through 15 years of plantation development revealed differences among provenances in height, diameter, and height/diameter ratio. The calculated variables, bole volume and aboveground biomass, showed large differences among provenances. Two provenances from northwestern Washington consistently were the most vigorous, two (Juneau, Alaska, and Sandpoint, Idaho) were the least vigorous, and the remaining six provenances shifted somewhat in ranking over time.

2300 (PB–89-870869/XAB) **Cellulose and lignin: Biodegradation. June 1987-September 1989 (Citations from the Life Sciences Collection data base). Report for June 1987-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 57p. Available from NTISPC N01/MF N01.

Supersedes PB–88-869003.

This bibliography contains citations concerning the biodegradation of waste cellulose, cellulose-containing substances, lignin, and lignin-containing substances. Attention is given to the organisms that decompose cellulose and lignin, and the processes by which this takes place. (This updated bibliography contains 120 citations, 46 of which are new entries to the previous edition.)

2301 (SAND–89-7036) **Loss minimization through recombination center identification.** Boeer, K.W.; Lu, Fu-Hsing. Sandia National Labs., Albuquerque, NM (USA); Delaware Univ., Newark, DE (USA). Dept. of Chemical Engineering. Oct 1989. 56p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE

Contract AC04-76DP00789. Order Number DE90001786. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The report contains a comparative evaluation of the finite element and the Kutta-Merson method by solving the same problems for a thin Si solar cell. Excellent agreement of the numerical results is shown. In the second part of the report, the Kutta-Merson method is used to investigate the influence of changing the charge character of a recombination center after the first carrier is trapped. Such change can result in a substantial change in open circuit voltage and fill-factor. The numerical results show that incorporation of usual recombination centers, which turn attractive to minority carriers when the first carrier is trapped, are detrimental to V_{oc}, and incorporation of sensitizing centers, which are doubly charged before recombination, are beneficial, that is, cause an increase of V_{oc} compared to neutral deep centers. The results indicate the need to incorporate a more refined recombination model in the finite element software. 15 refs., 18 figs., 7 tabs.

2302 (SAND–89-7039) **High-efficiency silicon concentrator solar cells for use with prismatic covers.** Culik, J.S.; Jackson, E.L. Sandia National Labs., Albuquerque, NM (USA); Astrosystems, Inc., Newark, DE (USA). Astropower Div. Oct 1989. 30p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE90002644. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Advanced-design 20X concentration silicon solar cells that are compatible with prismatic covers have been designed and fabricated. Our design is based upon a micro-machined, deeply grooved, three- dimensional silicon structure and incorporates a dual-layer emitter, oxide surface passivation layers for front and rear surfaces, and back surface reflector light-trapping technologies. Using "solar grade" Czochralski-grown silicon with a resistivity of 1.25 ohm-cm, we obtained open-circuit voltages as high as 679 mV and active-area current densities of up to 38.4 mA/cm^2. The best efficiency for a full-sized (50 cm^2) solar cell with prismatic cover is 17.8%. The performance of these devices is limited primarily by series resistance in the emitter and emitter contact due to the wide grid finger spacing (504 microns) and reflection from a groove ridgetop between the fingers. Increasing the density of front-contact fingers to eliminate the center ridge, together with a matched prismatic cover, will yield significant improvements in fill-factor and short-circuit current. Preliminary modeling of this design using PC-1D/2 indicates that efficiencies of up to 24% are feasible. With optimization of the fabrication sequence, the conversion efficiency of the deeply grooved concentrator solar cell should approach this level of performance.

2303 (SERI/STR–211-3410) **Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 3 final subcontract report, February 1, 1986–January 31, 1987.** Carlson, D.E.; Ayra, R.R.; Bennett, M.S.; Brewer, J.A.; Catalano, A.W.; D'Aiello, R.V.; Dickson, C.R.; Fortmann, C.M.; Newton, J.L.; O'Dowd, J.G.; Oswald, R.S.; Wiedeman, S. Solar Energy Research Inst., Golden, CO (USA); Solarex Corp., Newtown, PA (USA). Thin Film Div. Sep 1989. 94p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000846. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report present results of the third phase of research in high-efficiency, single-junction, monolithic, thin-film, a-Si solar cells. Six glow-discharge deposition systems, including an in-line multichamber system, were used to grow both doped and undoped a-Si films. In single load-lock system, a-Si was deposited over 1000- cm^2 substrates with less then a 1% variation in thickness and low oxygen impurity levels. The system produced 1000-cm^2 submodules with active-area efficiencies of 8.7%. A model was developed for light scattering in textured tin oxide that predicts scattered transmission through the air/glass/tin oxide/air configuration to within a few percent. Textured tin oxide films were grown by chemical vapor deposition using tin tetrachloride. Solar-cell efficiencies of about 11% were obtained in small-area p-i-n cells with reflective back contacts of Ti/Ag that exhibit external quantum efficiencies as high as 58.7% at 700 nm; other cells with ITO/Ag back contacts have had quantum efficiencies as high as 64% at 700 nm. High-performance cells were fabricated by employing dopant and carbon concentration gradients near the p/i interface. Total-area efficiencies around 8% were obtained for submodules in which the patterning was done by laser scribing. 11 refs., 35 figs., 18 tabs.

2304 (SERI/STR–211-3582) **Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 1, Annual subcontract report, February 1, 1987–January 31, 1988.** Catalano, A.W.; Carlson, D.E.; Ayra, R.R.; Bennett, M.S.; D'Aiello, R.V.; Dickson, C.R.; Fortmann, C.M.; Goldstein, B.; McVeigh, J.; Morris, J.; Newton, J.L.; Wiedeman, S. Solar Energy Research Inst., Golden, CO (USA). Oct 1989. 142p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. ZB-7-06003-2. Order Number DE89009495. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This document describes the progress made in obtaining stable, a-Si-based submodules that have a large area and high efficiency. Conversion efficiencies of up to 11.95% were obtained in small-area, single-junction a-Si solar cells using textured TiO_2, superlattice p-layers, graded carbon concentrations near the p/i interface, and highly reflective ITO/silver back contacts. Single- junction a-SiC and a-SiGe p-i-n cells were also fabricated that had conversion efficiencies of 9%–11%, and some recently fabricated stacked-junction cells had conversion efficiencies of about 10%. In materials research boron-doped microcrystalline SiC films were recently developed containing up to 6 at. % carbon with conductivities of $3 \times 10^{-3}/\Omega$-cm at room temperature and activation energies of 0.11 eV. Microcrystalline film growth was shown to be strongly influenced by the nature of the substrate, with nucleation occurring more readily on a-Si substrates than on TiO_2. Stability studies show that light-induced degradation is usually enhanced by the presence of carbon grading near the p/i interface. In general, adding either germanium (from GeH_4) or carbon (from CH_4) to the i-layer of a p-i-n cell leads to enhanced light-induced degradation. 13 refs., 80 figs., 17 tabs.

2305 (SERI/STR–211-3583) **Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 2, Semiannual report, February 1, 1988–July 31, 1989.** Ayra, R.R.; Bennett, M.S.; Dickson, C.R.; Fieselmann, B.; Fortmann, C.; Goldstein, B.; Morris, J.; O'Dowd, J.G.; Oswald, R.S.; Wiedeman, S.; Yang, L. Solar Energy Research Inst., Golden, CO (USA). Oct 1989. 120p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009496. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This document describes efforts to improve the quality of candidate photovoltaic materials used in amorphous wide- and narrow-band-gap materials, namely, a-$Si_{1-x}C_x$ and a-$Si_{1-x}Ge_x$. Although these alloys show a decrease in mobility-lifetime product as the fraction of silicon decreases, their optical properties show marked differences. Microcrystalline p-layer films containing carbon were prepared to evaluate their importance for achieving high open-circuit voltages. Silicon-germanium cells were studied to optimize their performance in multijunction, stacked cell structures. The best cells fabricated from the silicon-germanium alloys yielded a conversion efficiency of 10.1% with a band gap of 1.55 eV. Several alloy-based stacked cells had conversion efficiencies of more than 10%: an a-SiC/a-SiGe cell yielded 10.5% and an a-SiC:H/a-Si:H structure yielded 10.2%. Stacked-junction cells showed far less susceptibility to light-induced degradation.

2306 (SERI/STR–211-3585) **High-efficiency large-area CdTe modules: Annual subcontract report, 1 July 1988–30 June 1989.** Albright, S.P.; Ackerman, B. Solar Energy Research Inst., Golden, CO (USA). Oct 1989. 32p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009498. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This annual technical progress report covers Photon Energy Inc. (PEI) work to produce a small solar cell with an efficiency of 12.3%. The high efficiency of this device was largely due to improving the window layer. Analyzing the diode characteristics of this cell indicates that the largest potential for fill-factor improvement lies in reducing the diode quality factor. Through outdoor life-testing of encapsulated modules and accelerated lifetesting of laboratory cells, the CdS/CdTe structure has demonstrated the long-term stability

necessary for photovoltaic products. Also described is a preformed metal backcap, which is fitted with hermetic feed-through tubes and used for encapsulization. Using the results of these studies, PEI produced sample modules with efficiencies very close to the original objectives, including a $l\text{-}ft^2$ module with an output of 6.1 W and an active area of 754 cm^2. For this module, the active-area efficiency was 8.1% and the aperture efficiency was 7.3%. 9 refs., 12 figs., 3 tabs.

2307 (SERI/STR–211-3586) **Thin film cadmium telluride, zinc telluride, and mercury zinc telluride solar cells: Annual subcontract report, 1 July 1988–30 June 1989.** Chu, T.L. Solar Energy Research Inst., Golden, CO (USA); University of South Florida, Tampa, FL (USA). Oct 1989. 31p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. XL-8-18091-1. Order Number DE89009499. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report covers the first year of a program to investigate (1) the deposition of CdTe films by various techniques, (2) the deposition of transparent conducting semiconductor (TCS) films by various techniques, (3) the preparation and evaluation of thin-film CdTe solar cells, and (4) the deposition and characterization of ZnTe films and heterojunctions. CdTe films were deposited on glass and SnO_2/glass substrates by metal-organic chemical vapor deposition (MOCVD) by reacting dimethylcadmium (DMCd) with diisopropyltellurium (DITe) in H_2. The optical bandgap was 1.50 eV. The conductivity type of the films could be controlled by controlling the DMCd/DITe molar ratio in the reaction mixture. This is a promising technique for the preparation of thin-film CdTe homojunction solar cells. CdS films were deposited from aqueous solutions by reacting thiourea and cadmium acetate in an ammonical solution. The films show good optical transmission in the above-bandgap region but are porous and impure. The photovoltaic characteristics of cells employing solution-grown CdS films are therefore inferior to those employing vacuum-evaporated CdS films. Films of ZnO, ZnS, and ZnTe were deposited, via MOCVD, on glass and SnO_2/glass substrates, and ZnO/ZnTe heterojunctions were produced. Open-circuit voltages of 0.6–0.7 V were measured for ZnS/ZnTe heterojunctions. 14 refs., 21 figs., 3 tabs.

2308 (SERI/TP–211-3595) **US polycrystalline thin film solar cells program.** Ullal, H.S.; Zweibel, K.; Mitchell, R.L. Solar Energy Research Inst., Golden, CO (USA). Nov 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-891119–5: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE89009506. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Polycrystalline Thin Film Solar Cells Program, part of the United States National Photovoltaic Program, performs R&D on copper indium diselenide and cadmium telluride thin films. The objective of the Program is to support research to develop cells and modules that meet the US Department of Energy's long-term goals by achieving high efficiencies (15%-20%), low-cost ($50/$m^2$), and long-time reliability (30 years). The importance of work in this area is due to the fact that the polycrystalline thin-film $CuInSe_2$ and CdTe solar cells and modules have made rapid advances. They have become the leading thin films for PV in terms of efficiency and stability. The US Department of Energy has increased its funding through an initiative through the Solar Energy Research Institute in $CuInSe_2$ and CdTe with subcontracts to start in Spring 1990. 23 refs., 5 figs.

2309 (UCRL–21227-89) **Carbohydrate translocation and branch autonomy of Pinus ponderosa.** Houpis, J.L.J.; Benes, S.E. Lawrence Livermore National Lab., CA (USA). Mar 1989. 4p. Sponsored by University of California. DOE Contract W-7405-ENG-48. Order Number DE90001655. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We are testing the degree of mature branch autonomy in P. ponderosa using $^{14}CO_2$. Determination of the level of branch autonomy involves four elements that are based on pulsing one branchlet with $^{14}CO_2$: (1) determine if the canopy position of a branch in the canopy, of which one branchlet is pulsed with $^{14}CO_2$, affects the amount of $^{14}CO_2$ found in other types of tissue (stems, needles, buds) located on the same branch; (2) determine if the position (apical or lateral) of a branchlet that is pulsed with $^{14}CO_2$, affects the amount of $^{14}CO_2$ found in other tissue across different branchlets located on the same branch; (3) determine if the position of a branchlet in relation to the pulsed branchlet affect the amount of $^{14}CO_2$ that is traced into the target branchlet; and (4) determine if the length of time between pulsing and sampling of trace tissue affects the detection of $^{14}CO_2$. 2 refs.

2310 Low temperature diffusivity for aluminum and silver in amorphous silicon. Berry, W.B. (Notre Dame Univ., IN (USA)); Emery, K.A.; Swartzlander, A.B.; Nelson, A.J. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC02-83CH10093. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

This paper presents experimental results which determine the diffusivities for aluminum and silver in amorphous silicon using segments cut from test coupons and a fabricated module. The data extend the literature to a temperature range of 50^0C-300%C. The results agree with the relative order of magnitude of previously published work on aluminum over the temperature range of that data. The activation energy differs significantly.

2311 PC-1D version 2: Enhanced numerical solar cell modeling. . Basore, P.A. (Sandia National Labs., Albuquerque, NM (USA)); Rover, D.T.; Smith, A.W. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC04-76DP00789. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

PC-1D is a finite-element program for modeling semiconductor devices in one dimension on personal computers. Significant improvements have been made to the program, resulting in a new version. This paper describes the enhancements and their application to modern crystalline cells, including new provisions for heterostructures, anti-reflection coatings and light trapping, an upgraded user interface, and unattended operation for optimization studies.

2312 Useful life prediction for first generation a-Si photovoltaic modules using outdoor test data. Mrig, L.C. (Solar Energy Research Inst., Golden, CO (USA)); Berry, W.B. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC02-83CH10093. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

The design lifetime/performance goal for photovoltaic modules is 30 years. This paper presents an analysis of field test data for first generation a-Si modules under SERI's on-going field test and performance evaluation program. The program goal is to establish baseline data against which future development can be compared. To that end, models are discussed which represent the data and which begin to correlate basic cell and material studies to module field performance.

2313 Crystalline silicon photovoltaic cell technology: Meeting the challenge for utility power. . Arvizu, D.E. (Sandia National Labs., Albuquerque, NM (USA)). pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC04-76DP00789. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

This paper discusses the recent progress in U.S. crystalline silicon photovoltaic cell technology for both one-sun and concentrating applications. The progress in crystalline silicon technology has manifested itself in improved efficiency and in lower costs of processing and production. The new developments in crystalline silicon photovoltaic technology have prompted an optimistic assessment of its potential for utility applications. The status of the current research efforts and the direction of the U.S. Department of Energy sponsored crystalline silicon research program is discussed.

2314 An empirical investigation of the InP shallow-homojunction solar cell. Wanlass, M.W. (Solar Energy Research Inst., Golden, CO (USA)); Gessert, T.A.; Emery, K.A.; Coutts, T.J. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract

AC02-83CH10093. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

In this paper an experimental study of the performance of epitaxially grown InP shallow-homojunction solar cells as a function of the thickness and carrier concentration in the base and emitter layers is presented. An identification of improvements to cell design leading to higher performance is emphasized. As a result, using a near-optimum set of design parameters, cells with conversion efficiencies of 20.3% (global) and 17.6% (AMO) have been achieved. Discrepancies between the results of the present study and earlier modeling efforts are also outlined.

2315 **High volume processing of point contact solar cells.** Miner, G.E. (SERA Solar Corp., Santa Clara, CA (US)); Christel, L.A. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Point contact solar cells have achieved the highest efficiencies recorded to data for silicon cells, reaching 28.2% at 10 Watts/cm^2, and have been shown to be capable of achieving efficiencies of over 30%. While this technology offers several advantages over conventional bifacial cells, it demands special process techniques to optimize cell efficiency. Point contact cells require a thin base, high bulk lifetime, low surface recombination velocities, effective light trapping, and effective heat sinking. This work addresses some of these production issues in implementing a point contact cell process using standard, high volume, semiconductor manufacturing equipment. Modifications to equipment and procedures are described which increase process yield and cell efficiency. Improvements are suggested which are expected to yield still higher efficiencies.

2316 **Safety considerations for high-efficiency crystalline-silicon solar cell fabrication.** Ruby, D.S. (Sandia National Labs., Albuquerque, NM (USA)). pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC04-76DP00789. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

The fabrication of high-efficiency crystalline-silicon solar cells involves the use of hazardous chemicals which must be handled carefully and disposed of properly. This can be done in a facility that has been designed to minimize the probability of having an accident and which mitigates the damage of those that do occur. An analysis of such safety features is presented here for a facility designed to fabricate crystalline-silicon solar cells of the types shown to exhibit record-high efficiencies, both under concentrated and one-sun illumination. For comparison, the analogous safety measures that need to be taken in a thin-film solar cell production facility are also noted.

2317 **Hybrid solar cells based on DC magnetron sputtered films of n-ITO on APMOVPE grown p-InP.** Coutts, T.J. (Solar Energy Research Inst., Golden, CO (USA)); Li, X.; Wanlass, M.W.; Emery, K.A.; Gessert, T.A. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Hybrid indium tin oxide (ITO)/InP solar cells are discussed. The cells are constructed by DC magnetron sputter depositing ITO onto high quality InP films grown by atmospheric pressure metal organic vapor phase epitaxy. A record efficiency of 18.9%, measured under standard SERI reporting conditions, has been obtained. A discussion of associated quantum efficiencies and capacitance/voltage measurements is also presented from which it is concluded that further improvements in efficiency will result from better control over the type conversion process.

2318 **22.8% efficient silicon solar cell.** Blakers, A.W. (Solar Photovoltaic Laboratory, Joint Microelectronics Research Centre, University of New South Wales, Kensington 2033, Australia (AU)); Wang, A.; Milne, A.M.; Zhao, J.; Green, M.A. *Applied Physics Letters (USA)*, 55(13): 1363-1365 (25 Sep 1989).

A new silicon solar cell structure, the passivated emitter and rear cell, is described. The cell structure has yielded independently confirmed efficiencies of up to 22.8%, the highest ever reported for a silicon cell.

2319 **GaSb booster cells for over 30% efficient solar-cell stacks.** Fraas, L.M. (Boeing High Technology Center, Seattle, Washington 98124-6269 (US)); Girard, G.R.; Avery, J.E.; Arau, B.A.; Sundaram, V.S.; Thompson, A.G.; Gee, J.M. *Journal of Applied Physics (USA)*, 66(8): 3866-3870 (15 Oct 1989).

The fabrication of GaSb infrared-sensitive photovoltaic cells designed to boost the energy-conversion efficiency in tandem solar cell stacks is reported. Located behind GaAs solar-cells in 50× concentrated light configurations, these GaSb cells will boost the stack efficiency by 6.5 percentage points for space (AM0) and 7.0 percentage points for terrestrial (AM1.5D) applications. Assuming a GaAs cell efficiency of 26.7% (AM1.5D, 50×) as recently reported, the GaAs on GaSb stack efficiency will be 33.7%. Reduced series resistance in future GaSb cells will allow tandem-stack energy-conversion efficiencies over 35%.

1406 Photovoltaic Power Systems

Refer also to citation(s) 2313

1407 Solar Thermal Power Systems

2320 (N–89-27256) **Thermal evaluation of advanced solar dynamic heat receiver performance. Final report, January-December 1988.** Crane, R.A. University of South Florida, Tampa, FL (USA). Mar 1989. 131p. (NASA-CR–185117;NAS–1.26:185117). Available from NTIS, PC A07/MF A01.

The thermal performance of a variety of concepts for thermal energy storage as applied to solar dynamic applications is discussed. It is recognized that designs providing large thermal gradients or large temperature swings during orbit are susceptible to early mechanical failure. Concepts incorporating heat pipe technology may encounter operational limitations over sufficiently large ranges. By reviewing the thermal performance of basic designs, the relative merits of the basic concepts are compared. In addition the effect of thermal enhancement and metal utilization as applied to each design provides a partial characterization of the performance improvements to be achieved by developing these technologies.

2321 **Potential of advanced-design solar central receiver power systems.** Tracey, T.R. (Sandia National Labs., Albuquerque, NM (USA)); Tyner, C.E.; Weber, E.R. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

Criteria for the analysis, design, and operation of solar central receiver (SCR) power systems using molten salt working fluids have been developed based on many years of experience. Important among these criteria are eliminating high stresses in receiver tubes, minimizing trace heating and the number of valves, reducing system pressure, using simple and reliable pumps, simplifying control and startup, and minimizing scaleup risk. In this paper the authors discuss how a system using a falling film direct absorption receiver (DAR) and other advanced-design concepts may meet these criteria better than more conventional designs. In addition to the receiver, they examine potential areas for simplification and improvement in the areas of the steam generator system (SGS), trace heating, valves, pumps, and piping. They re-examine the potential benefits of system modularization, taking into account unique features of the DAR. Implementation of the many potential advanced-design concepts available from a DAR-based system will require substantial changes in conventional molten salt SCR designs. In this paper, they discuss the potential of these design changes and barriers to their implementation.

2322 **The economic potential of a photovoltaic central receiver power plant.** Menicucci, D. (Sandia National Labs., Albuquerque, NM (USA)); Kolb, G. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

The concept of a photovoltaic central receiver system has existed for about ten years, but was not seriously considered because of the high cost and marginal quality of the photovoltaic (PV) cells. Recent breakthroughs in PV cell efficiency and quality coupled with the design of low-cost heliostats have justified reconsideration of the concept. This paper compares the economic potential of a photovoltaic central receiver (PVCR) plant with molten salt central receivers and with a Fresnel lens photovoltaic concentrator system. The systems are compared by analyzing the costs and efficiencies of the subsystems and components. By applying a common set of economic assumptions, this information is used to estimate both installed and levelized energy costs for each of the systems. The paper also outlines some of the significant technical problems that must be solved before a PVCR system can be cost-effective. An experimental program designed to address these problems is described, and some preliminary results are presented.

2323 **Internal film receiver design and systems assessment.** Anderson, J. (Solar Energy Research Inst., Golden, CO (USA)); Buna, T. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

The internal film receiver (IFR) concept involves flowing a film of fluid (molten nitrate salt in this case) over one side of a sloped plate with concentrated solar radiation is focused on the other side. This paper documents a preliminary design study and system assessment effort carried out by the Solar Energy Research Institute. The project included a conceptual design engineering assessment and a systems analysis. The objective of this effort was to compare the IFR concept with conventional salt-in-tube receivers and with the direct absorption receiver (DAR). Major outputs from this effort included assessment of the performance and economic potential of the IFR and identification of the major technical issues associated with this concept. In general, the IFR concept displays many of the same technical advantages and technical issues anticipated for the DAR. The systems assessments results indicate that the IFR has the potential for levelized energy cost (LEC) reductions of 5%-8% over conventional salt-in-tube receivers.

2324 **Drop ejection in molten-salt direct absorption central receivers.** Bohn, M.S. (Solar Energy Research Inst., Golden, CO (USA)); Stern, C.H. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

Although the molten-salt direct absorption receiver concept promises significant improvements in central receiver system cost and efficiency, several technical issues remain before successful commercial implementation can be expected. One such issue is the possibility that the flowing molten-salt film can eject salt droplets into the area surrounding the receiver tower. This paper presents measurements of droplet ejection from a 5 m long by 0.27 m wide panel with a flowing film of molten nitrate sale. Measurements of the rate at which mass is ejected at various locations along the panel height were made for various flow rates and salt temperatures. Local measurements of film thickness were also made for various flow rates and salt temperatures. Besides quantifying the problem, the data suggest mechanisms for the droplet ejection phenomenon and possible methods to ameliorate the problem.

2325 **Improved operational performance of the Shenandoah Solar Total Energy Project.** Nelson, R.F. (Georgia Power Co., Shenandoah, GA (USA)); Heckes, A.A. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

This paper presents the results of selected design modifications to the Shenandoah Solar Total Energy Project (STEP) at Shenandoah, Georgia. The manpower required to operate the plant was significantly reduced, the loss rate of heat transfer fluid was slowed, and the system reliability improved so that the plant currently performs as originally intended. The items that brought about the improved operation include a new control system, a steam superheater, a larger boiler tube sheet, and a pressurized expansion tank for the heat transfer fluid. The aluminized film on five solar collectors was replaced with silvered film to improve the reflectivity and to field test its survivability.

2326 **Comparison of a cavity solar receiver numerical model and experimental data.** Hogan, R.E. (Sandia National Labs., Albuquerque, NM (USA)); Diver, R.B.; Stine, W.B. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

A numerical model which predicts the thermal environment in axisymmetric solar cavity receivers is described. The computed energy transfer rates and temperatures are compared to experimental data for tests of a novel test bed receiver in the Sandia National Laboratories solar furnace. In general, the numerical model captures the trends observed in the experimental data. Sensitivity analyses show that the total solar energy input rate and the convective heat loss coefficient have a significant effect on the thermal performance and that the input solar flux distribution has a significant effect on the receiver temperature distribution in these experiments.

2327 **Design considerations for heat-pipe solar receivers.** Adkins, D.R. (Sandia National Labs., Albuquerque, NM (USA)). pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

Heat pipes are being developed to transfer solar energy from the focal point of a parabolic dish concentrator to the working fluid of Stirling engines. With these receivers, concentrated solar energy that is absorbed on the concave surface of a dome is removed by the evaporation of liquid sodium on the convex side of the dome. Vaporized sodium then condenses on an engine's heater tubes and transfers energy to the working fluid of the engine. The condensed sodium returns to the absorber surface where it is redistributed across the dome by the capillary action of a wick. Issues concerning the flow of sodium in a heat-pipe solar receiver are investigated in this paper. A comparison is made between various wick options, and general issues concerning the design of heat pipe receivers are also discussed.

2328 **An assessment of the optical performance of stretched-membrane mirror modules.** Alpert, D.J. (Sandia National Labs., Albuquerque, NM (USA)); Houser, R.M. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

The United States Department of Energy's solar thermal program is developing an innovative concept for the heliostats used in a solar central-receiver power plant: replacing the familiar glass mirrors with stretched-membrane reflectors. This paper presents Sandia's assessment of first- and second-generation mirror modules made of stretched membranes. The first prototype mirror modules were built in 1986 by two contractors to Sandia. Sandia completed an evaluation of the optical performance of the two mirror modules in 1988. Using the experience gained with the first prototypes, and incorporating the results of Sandia's evaluation, the same two contractors designed improved stretched-membrane heliostats. A prototype of one design has been installed at the Central Receiver Test Facility, and Sandia's preliminary assessment shows the quality of its beam to be as good as current glass-mirror heliostats. The second prototype will be installed in early 1989.

2329 **Structural integrity studies of an external direct absorption solar central receiver.** Narayanan, T.V. (Foster Wheeler Corp., Livingston, NJ (USA)); Wu, S.F. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical

Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

In a joint SNL/SERI 3-year Direct Absorption Receiver (DAR) research and development program to determine concept feasibility, Foster Wheeler Solar Development Corporation conducted a design study of a commercial-size DAR. This paper summarizes the structural integrity considerations of that study. After extensive preliminary analyses and trade-off studies, an integral shell DAR design was adopted for the 320-MWt external receiver. Unlike the conventional tubular receiver, the major failure modes of concern in the DAR receiver are buckling and vibration. This problem was overcome by precompressed spring supports, which do not restrain the radially outward movement of the shell. The pretensioned bottom springs not only introduce a prestress in the shell, helping to counteract the compressive thermal stresses, but also help reduce wind-induced deflections and vibrations. Extensive large-displacement finite-element analyses were performed to evaluate the effect of varying critical design parameters such as shell thickness, pretension, length of spring, spring offset, and bottom ring beam sizes. This paper describes these analyses and the optimization of the various parameters.

1408 Ocean Energy Systems

2330 **Integration and optimization of the gas removal system for hybrid-cycle otec power plants.** Rabas, T.J. (Argonne National Lab., IL (USA)); Panchal, C.B.; Stevens, H.C. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract W-31-109-ENG-38. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

A preliminary design of the noncondensible-gas removal system for a 10 MWe, land-based, hybrid-cycle OTEC power plant has been developed and is presented herein. This gas removal system is very different from that used for conventional power plants because of the substantially larger and continuous noncondensible-gas flow rates and lower condenser pressure levels which predicate the need for higher-efficiency components. Previous OTEC studies discussed the need for multiple, high-efficiency compressors with intercoolers; however, no previous design effort was devoted to the details of the intercoolers, integration and optimization of the intercoolers with the compressors, and the practical design constraints and feasibility issues of these components. A computerized calculation method was developed for the performance analysis and subsystem optimization. For a specified number of compressor units and the stream arrangement, the method is used to calculate the dimensions, speeds, power requirements, and costs of all the components.

2331 **Operational experience of the OC-OTEC experiments at NELH.** Link, H. (Solar Energy Research Inst., Golden, CO (USA)). pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

The Solar Energy Research Institute, under funding and program direction from the U.S. Department of Energy, has been operating a small-scale test apparatus to investigate key components of an open-cycle ocean thermal energy conversion (OC-OTEC). The apparatus started operations in October 1987 and continues to provide valuable information on heat- and mass-transfer processes in evaporators and condensers, gas sorption processes as seawater is depressurized and repressurized, and control and instrumentation characteristics of open-cycle systems. This is the largest apparatus of its kind to use seawater since Georges Claude's efforts in 1926. The information obtained from experiments conducted in this apparatus is being used to design a larger scale experiment in which a positive net power production is expected to be demonstrated for the first time with OC-OTEC. This paper describes the apparatus, the major tests conducted during its first 18 months of operation, and the experience gained in OC-OTEC system operation.

1409 Solar Thermal Utilization

Refer also to citation(s) 2676

2332 (DOE/SF/16306–18) **Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of September and October 1989.** Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab. Nov 1989. 18p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG03-86SF16306. Order Number DE90002536. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective is to develop and test various integrated solar heating, cooling and domestic hot water systems, and to evaluate their performance. Systems composed of new, as well as previously tested, components are carefully integrated so that effects of new components on system performance can be clearly delineated. The program for 1989-90 is separated into seven tasks. There are tasks for each of the three solar houses, a project to build and test several generic solar water heaters, a task involving development of an improved evacuated tube collector, a management task, and a task under which an international workshop will test IEA Task VI models. The objectives and progress in each task are described in this report. 2 figs.

2333 (ECN-PB–89-4) **Experiences with the application of a solar boiler on a camping-site in Sint Maartenszee, Netherlands.** Bakema, G.F.; Schuurman, J.J. Netherlands Energy Research Foundation, Petten (Netherlands). Jun 1989. 42p. (In (In Dutch)). Order Number DE90722428.

In 1987 a solar hot-water system, consisting of a flat-plate collector with an area of 99 m^2 and a 10,000 liter storage-tank, has been installed at camping-site Sint Maartenszee near the North Sea coast in North-Holland (the Netherlands). From April to September 1988 this system has been monitored by the Netherlands Energy Research Foundation (ECN). Descriptions are given of the camping-site, the sanitary, the solar boiler and the measuring setting up. The measuring results for the period April-September 1988 are presented. Then an evaluation is given of the working of the system during two totally different days as to the weather conditions. Finally it has been examined what energy yield can be realized by the system for optimal conditions. Also an economical evaluation has been given of the system in 1988 and of an improved system. 13 figs., 3 refs., 4 tabs., 1 app.

2334 **Space heating performance of the ghost ranch sundwellings.** Johnson, B.K. (Battelle Pacific Northwest Lab., Richland, WA (USA)); Kreider, J.F. pp. 515 of Proceedings of Solar 88, the 13th national passive solar conference. American Solar Energy Society, New York, NY (1988). (CONF-8806384–: 13. national passive solar conference, Cambridge, MA (USA), 20-24 Jun 1988).

Space heating performance of four buildings is presented. Solar radiation and temperature data were collected through a short-term monitoring program. A macrodynamic approach is used to extract building parameters from the data, with which long-term performance is determined. A particular macrodynamic method, Building Element Vector Analysis (BEVA), is demonstrated.

2335 **Determination and application of bidirectional solar-optical properties of fenestration systems.** Papamichael, K. (Lawrence Berkeley Lab., CA (USA)); Klems, J.; Selkowitz, S. pp. 515 of Proceedings of Solar 88, the 13th national passive solar conference. American Solar Energy Society, New York, NY (1988). DOE Contract AC03-76SF00098. (CONF-8806384–: 13. national passive solar conference, Cambridge, MA (USA), 20-24 Jun 1988).

Accurate determination of the luminous and thermal performance of fenestration systems that incorporate optically complex components requires detailed knowledge of their radiant behavior. The authors describe a large scanning radiometer used to measure the bidirectional transmittance and reflectance of fenestration systems and components. They present examples of measured data obtained for simple non-specular samples. They describe a method of obtaining the overall properties of fenestration systems by calculation from scanning radiometer measurements of fenestration components. Finally, they describe the application of bidirectional

solar-optical properties of fenestration system to determine their luminous and thermal performance with respect to building energy consumption and occupants' comfort. They also discuss the advantages and limitations of the method, which appears to be promising.

2336 Effect of non-absorbable gas on the performance of a falling film absorber for open-cycle absorption solar cooling system. Habib, H.M. (Arizona State Univ., Tempe, AZ (USA)); Wood, B.D.; Murthy, J.Y. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

Numerical solutions are presented for the effect of a non-absorbable gas on the heat and mass transfer rates during the absorption of water vapor by a falling laminar smooth films of an aqueous lithium bromide or aqueous lithium chloride solution (absorbent). The geometry consists of a vertical channel with two walls, one of which is isothermal and the other adiabatic. The liquid film of an absorbent flows down over the isothermal wall, while a mixture of water vapor and air flows between the liquid free-surface and the adiabatic wall. The whole system is kept under vacuum pressures. Water vapor is absorbed by the film and air is the non-absorbable gas. The momentum, energy, and concentration equations are written with a set of interfacial and boundary conditions and solved numerically for the two phases. Variable property effects are included, as well as the interfacial shear. Heat and mass transfer results are presented over a wide range of inlet air concentrations.

2337 Heat transfer and pressure drop measurements in an air/molten salt direct-contact heat exchanger. Bohn, M.S. (Solar Energy Research Inst., Golden, CO (USA)). pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

This paper presents a comparison of experimental data with a recently published model of heat exchange in irrigated packed beds. Heat transfer and pressure drop were measured in a 150 mm (ID) column with a 610-mm bed of metal Pall rings. Molten nitrate salt and preheated air were the working fluids with a salt inlet temperature of approximately 440^{0}C and air inlet temperatures of approximately 230^{0}C. A comparison between the experimental data and the heat transfer model is made on the basis of heat transfer from the salt. For the range of air and salt flow rates tested, 0.3 to 1.2 kg/m^2 s air flow and 6 to 18 kg/m^2 s salt flow, the data agree with the model within 22% standard deviation. In addition, a model for the column pressure drop was validated, agreeing with the experimental data within 18% standard deviation over the range of column pressure drop from 40 to 1250 Pa/m.

2338 Spectral model for instantaneous advanced window performance. Soule, D.E. (Solar Energy Research Inst., Golden, CO (USA)). pp. 515 of Proceedings of Solar 88, the 13th national passive solar conference. American Solar Energy Society, New York, NY (1988). (CONF-8806384–: 13. national passive solar conference, Cambridge, MA (USA), 20-24 Jun 1988).

A spectral model is developed for advanced windows with high spectral selectivity. The local instantaneous incident solar spectrum is introduced from the Bird and Riordan atmospheric parametric mode. Hemispherical spectral reflection from typical ground covers is added. A series of advanced double-pane windows including the vacuum window is investigated with spectral selectivity and transmittance half-width. The influence of spectrally selective low-E (SSLE) films is emphasized. Performance of vertical windows facing N, S, E, W is evaluated for specific window tasks: daylighting, ultraviolet load avoidance, summer cooling load avoidance, and winter solar heating. Typical day 24 hour integrations of the window's net energy throughput are projected to establish overall seasonal window performance.

2339 Field survey of 259 active solar DHW systems. Carlisle, N. (Solar Energy Research Inst., Golden, CO (USA)); Farrington, R. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

To obtain information on the reliability of active solar domestic water heating (SDHW) systems installed since 1985, the Solar Energy Research Institute (SERI) contracted with local organizations to perform site inspections and collect repair data from homeowners in 4 geographic locations. This paper provides data resulting from 259 site inspections and homeowner surveys. Survey results are presented on system types, installation quality, problems identified by component, system repair costs and incidence of repair. A significant result of this study is that it did not reveal systematic failures of particular components. The major problems were ones common to all types of solar systems and not a result of particular system designs.

2340 Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems. Pesaran, A.A. (Solar Energy Research Inst., Golden, CO (USA)); Bingham, C.E. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

Four experimental test facilities for characterizing the performance of solid desiccant materials and dehumidifier matrices which have the potential to be used in solar-regenerated desiccant cooling systems are reviewed. The water equilibrium capacity and sorption rates of desiccant materials, depending on their form, can be either measured with a quartz crystal microbalance or a desiccant sorption test facility. Pressure drop, heat- and mass-transfer rates and transient equilibrium dehumidification capacity of a dehumidifier matrices are measured in a desiccant heat and mass transfer test facility. The performance and steady state dehumidification capabilities of prototype dehumidifier components under realistic conditions are measured in a desiccant cyclic test facility. The description of the test apparatus, experimental procedure, measurement errors, and typical results for the four test facilities are presented here.

2341 Measurement uncertainty of adsorption testing of desiccant materials. Bingham, C.E. (Solar Energy Research Inst., Golden, CO (USA)); Pesaran, A.A. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

The technique of measurement uncertainty analysis as described in the current ANSI/ASME standard is applied to the testing of desiccant materials in SERI's Sorption Test Facility. This paper estimates the elemental precision and systematic errors in these tests and propagates them separately to obtain the resulting uncertainty of the test parameters, including relative humidity (+-.03) and sorption capacity (+-.002 g/g). Errors generated by instrument calibration, data acquisition, and data reduction are considered. Measurement parameters that would improve the uncertainty of the results are identified. Using the uncertainty in the moisture capacity of a desiccant, the design engineer can estimate the uncertainty in performance of a dehumidifier for desiccant cooling system with confidence.

2342 Window 3.1: A computer tool for analyzing window thermal performance. . Reilly, S. (Lawrence Berkeley Lab., CA (USA)); Arasteh, D. pp. 515 of Proceedings of Solar 88, the 13th national passive solar conference. American Solar Energy Society, New York, NY (1988). (CONF-8806384–: 13. national passive solar conference, Cambridge, MA (USA), 20-24 Jun 1988).

WINDOW 3.1 is a public-domain computer program developed by the Windows and Daylighting Group at Lawrence Berkeley Laboratory for analyzing heat transfer through window systems. The program uses an iterative technique to calculate the one-dimensional temperature profile across a user-defined window system. From this data, window system performance indices (e.g., U-value, shading coefficient) are calculated. WINDOW 3.1, a major update to WINDOW 2.0, incorporates several technical additions and many new user-friendly features, and provides a consistent and versatile means for heat transfer analysis as did WINDOW 2.0.

WINDOW 3.1 can vary environmental conditions, window tilt, number of glazing layers, layer properties (thermal infrared, solar and visible optical properties, and thermal conductance), gap widths, composition of gap gas fill, and spacer and frame materials. This paper presents an overview of the computational methodology, describes the capabilities of the program, and discusses the applications of WINDOW 3.1 for standardizing window heat transfer calculations and in designing new insulating window systems.

2343 **Short-time-scale measurements of fenestration thermal performance under realistic springtime conditions.** Klems, J.H. (Lawrence Berkeley Lab., CA (USA)); Keller, H. pp. 515 of Proceedings of Solar 88, the 13th national passive solar conference. American Solar Energy Society, New York, NY (1988). (CONF-8806384–: 13. national passive solar conference, Cambridge, MA (USA), 20-24 Jun 1988).

The thermal performance of several simple fenestrations closely approximating the assumptions of ASHRAE heat-transfer calculation model was measured in both south-facing and north-facing orientations under realistic field conditions using the new MoWiTT field test facility. The time-dependent net heat flow through each fenestration was found to be consistent with the predictions of the model, provided that an angle-dependent solar factor was used and diffuse solar gain was included in the calculation. Summer-condition average U-values were derived for each glazing type and were found to agree with the expected values for both clear and low-emissivity double glazing. The measured U-value for single glazing was lower than predicted.

2344 **Metal substrates and the photodegradation of polymers. Pt. 2. An FTIR study of polyethylene terephthalate and polyvinyl fluoride.** Smith, D.M. (Denver Univ., CO (USA). Dept. of Chemistry); Welch, W.F.; Graham, S.M.; Chughtai, A.R.; Schissel, P. *Solar Energy Materials (Netherlands),* 19(1/2): 111-120 (Sep 1989). Grant MPS-75-0620;ATM-83-00524. (CONF-8708236–: 6. conference on optical materials technology for energy efficiency and solar energy conversion, San Diego, CA (USA), 18-19 Aug 1987).

The effect of several metal substrates (Al, Cu, Ag, and Au) on the photodegradation of polyethylene terephthalate (PET) and polyvinyl fluoride (PVF) films has been examined. The effect of M on M/PET systems under both oxidative and non-oxidative conditions shows that the orders of photodegradation are: Cu/PET>>Al/PET>PET>Au/PET>Ag/PET (non-oxidative) and Cu/PET>>PET>Al/PET>Au/PET>Ag/PET (oxidative). The effect of M on M/PVF films when irradiated under non-oxidative conditions shows that all metals have an adverse effect on the photodegradation of these films. Under oxidative conditions, Cu/PVF shows extreme photodegradation while the other M/PVF films show far less photodegradation than under the non-oxidative conditions. The trends in photodegradation are as follows: Al/PVF>>Cu/PVF>Au/PVF>Ag/PVF>PVF (non-oxidative) and Cu/PVF>>PVF>Al/PVF>Au/PVF>Ag/PVF (oxidative). (orig.).

1410 Solar Collectors and Concentrators

Refer also to citation(s) 2313

2345 (DTH-LV–87-11) **Plastic foil absorbers for solar collectors.** Oestergaard Jensen, S. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Aug 1987. 40p. (In Danish). Order Number DE90719270. Available from NTIS (US Sales Only), PC A03/MF A01.

A solar absorber made of transparent foils consisting of a polyamide and polyethylene laminate was investigated. Because of the transparency of the layers, the fluid between them is absorbant and, in this case, runs between them. It was shown that the laminate could not sufficiently withstand the sun's ultraviolet rays, but it could possibly be utilized in connection with solar collecters without a protective covering (for example where they are used to heat swimming pools) because in this case the stagnation temperature does not present a problem. It was proved possible to achieve a satisfactory flow profile regarding the fluid running between the plastic foil layers. It was concluded that economically these foils may not be able to compete with absorbers made of metal because of the problems related to ultraviolet radiation. (AB).

2346 (ETDE-mf–0721861) **Radiation-physical properties of selective solar absorbers.** Gindele, K.J. Stuttgart Univ. (Germany, F.R.). Fakultaet 4 - Elektrotechnik. 22 Jun 1988. 117p. (In German). Order Number DE90721861. Available from NTIS (US Sales Only), PC A06/MF A01.

An optical measurement method is presented which allows to measure the radiation-physical properties of surfaces, especially of selective solar radiation absorbing layers, both as spectral and as total radiation quantity and to cover both the solar and the thermal radiation range. In detail, the report deals with selective layers and their characterization as well as with radiation-physical quantities and measurements of radiation-physical properties (radiometry, backscatter method, thermal and spectral measurements). Furthermore, details are given about the spectrometer (optics, noise) and the measurements of the spectral emissivity in the infrared range by means of the backscatter method, as well as about characteristics of the IR backscatter technique. Finally, applications of the measurement techniques and results are presented (contribution to the understanding of the interaction between electromagnetic radiation and matter in the case of metal/dielectric layers as well as rough surfaces). (HWJ).

2347 (NEI-DK–225) **Development of solar collector modules.** Forman, T.; Christensen, H.J. Aidt Miljoe, Hadsten (Denmark). Mar 1989. 24p. (In Danish). Order Number DE90719264. Available from NTIS (US Sales Only), PC A03/MF A01.

Description of 3 solar collector modules, a self-circulating, low-flow and a larger 12m2 module, initiated by Denmark's Technical University in collaboration with Esbensens, The Danish firm of consulting engineers. The article also provides an explanation of construction methods, installation instructions, and a discussion of performance efficiency and properties of the materials utilized. Diagrams illustrate the text. (AB).

2348 **Optical properties of one and two-stage concentrator systems with non-paraboloidal and non-axisymmetric primaries.** O'Gallagher, J. (Chicago Univ., IL (USA)); Winston, R.; Lewandowski, A. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

A two-stage maximally concentrating optical system consists of a point focus primary combined with an optimized nonimaging secondary of the CPC or "trumpet" type. In previous work, such configurations have been shown to have significant advantages over conventional single stage designs for solar thermal applications. In this work, an optical and thermal model for the analysis of point focus thermal concentrators with and without secondaries has been generalized and improved. The main feature of the improved model is a procedure for tracing rays reflected off surfaces whose radial profile is not analytic, but instead is defined by discreet point co-ordinates. This new technique for analyzing arbitrary, well behaved, optical shapes, uses a cubic spline interpolation procedure and a modified Newton-Raphson method to trace a large number of rays reflected off the primary. It provides a versatile method for studying a variety of primary shapes.

2349 **Maintenance of brine transparency in salinity gradient solar ponds.** Hull, J.R. (Argonne National Lab., IL (USA)). pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract W-31109-ENG-38. (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

Experience with maintenance of brine transparency during the more than eight years of operation of the 1000-m^2 Research Salinity Gradient Solar Pond (RSGSP) at Argonne National Laboratory suggests that, in many sodium chloride brines, algal growth may be readily curtailed by minimizing the phosphate content of the brine. The addition of modest amount of aluminum sulfate (< 5 g m^{-2} yr^{-1}) to precipitate soluble phosphate in the RSGSP has resulted in a reduction of the amount of chlorine used from 13 g m^{-2} yr^{-1} to 2.8 g m^{-2} yr^{-1}, while still maintaining good transparency in the pond brine.

2350 **LANSIR: An instrument for measuring the light-scattering properties of laminate membrane mirrors.** . Wendelin, T.J. (Solar Energy Research Inst., Golden, CO (USA)); Wood, R.L. pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

This paper describes a large aperture, near-specular imaging reflectometer, (LANSIR), designed and built for performing optical surface quality tests on laminate mirror specimens. LANSIR can quantify the extent of reflective light-scattering from the surface of mirrors whose radii of curvature range from infinite (i.e., flat) down to approximately 15m in length. LANSIR has been used to investigate metalized polymer film reflective surfaces laminated to structural metal, polymer, and composite material substrates such as those used in stretched-membrane heliostats and dishes. Mirror samples from DOE-sponsored membrane heliostat and dish research and development efforts have exhibited scatter within the acceptable limits for moderate temperature applications as determined by solar thermal systems analyses. In addition, prolonged membrane stress appears to have little effect on the light-scattering properties of these samples. Using LANSIR to study the near-specular scattering properties of these mirrors, the authors have pointed out the need for continued attention to new materials and to new forming and joining processes for membrane mirrors.

1420 Heat Storage

Refer also to citation(s) 2566

2351 (CTH-JVG–27) **Sunclay clay plant at Kungsbacka. Technical follow-up of the thermal storage.** Rhen, I. Chalmers Inst. of Tech., Goeteborg (Sweden). Earth Heat Pump Group. May 1988. 46p. (In Swedish). Order Number DE90719416. Available from NTIS (US Sales Only), PC A03/MF A01.

The Lindaelv school at Kungsbacka is supplied with solar heating from a system with heat pumps and a heat storage in clay. The storage is arranged on post-glacial clay which contains sulfide and shell rests at some levels and is slightly overconsolidated. The heat storage consists of 612 U-tubes of PEH, arranged vertically to a depth of 35 m below the ground surface. Totally installed tube length is 42000 m and the distance between tubes c. 2 m. The storage occupies a ground area of 38x65 m^2, which supplies a storage volume of 87000 m^3. The mean temperature of the heat storage increased from c. +8 deg C in 1980 to c. +12 deg C in 1984. During 1984 the lowest and highest mean temperature of the storage was 9 deg C and 15 deg C respectively. Because of the low hydraulic conductivity of the clay the water expansion in the storage causes an increased pore water pressure and a ground heaving.

2352 (DTH-LV–88-18) **Pilot project for a larger solar heating system with seasonal heat storage. Further documentation of borehole storage yield and economy.** Andersen, S.; Ussing, V. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Oct 1988. 29p. (In Danish). Order Number DE90718971. Available from NTIS (US Sales Only), PC A03.

Further documentation of borehole heat storage yield and economy in connection with seasonal heat storage for terrace houses with a collective solar heating system. The system was found to be considerably cheaper than other heat storage methods. The energy flow showed a heat loss throughout 4 years of 14% where a heat pump was utilized and about 30% without the use of a heat pump. When it is possible that the boreholes reach a greater depth, the heat loss is less. It is considered that a mixture of sand, fly ash and water used to surround the underground tubes in the boreholes increases heat conducting capacity. The construction of the boreholes is described. A number of illustrative charts and graphs are also presented. (AB).

15 GEOTHERMAL ENERGY

1505 Economic and Financial Aspects

Refer also to citation(s) 2353, 2647

1508 Geothermal Power Plants

2353 (DOE-tr–89-18) **On economics of hot dry rock geothermal power station.** USDOE, Washington, DC (USA). 1989. 30p. Translation source information not available. Sponsored by U.S. DOE Management & Administration. Order Number DE90002697. Available from NTIS, PC A03/MF A01 - OSTI.

In order to clarify resources and economics of hot dry rock geothermal power stations in Japan, the Hot Dry Rock Geothermal Power Station Cost Study Committee was established. The Committee made a standard hot rock model based on Japanese geothermal core structures, drilling technology, and hydraulic fracturing technology with various investigations and estimated overall cost of the geothermal power station.

2354 (EGG-EP–8708) **Aspects of the Kalina technology applied to geothermal power production.** Bliem, C.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). 21 Sep 1989. 63p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE90002028. Available from NTIS, PC A04/MF A01 - OSTI.

This report contains the results of studies conducted at the Idaho National Engineering Laboratory (INEL) concerning the applicability of the Kalina technology to geothermal (hydrothermal) power production. This report represents a correction and addition to that report. The Heat Cycle Research Program (HCRP) has as its primary goal the cost-effective production of electric power from moderate temperature hydrothermal resources. Recent work has included the study of supercritical cycles with counterflow condensation which utilize mixtures as working fluids. These advanced concepts are projected to give a 20 to 30% improvement in power produced per unit geofluid flow rate (geofluid effectiveness, w hr/lb). The original Kalina cycle is a system which is similar to the cycles being studied in the Heat Cycle Research program and it was felt that this new cycle should be studied in the geothermal context. 15 refs., 9 figs., 2 tabs.

1509 Geothermal Engineering

Refer also to citation(s) 2353, 2359, 2360

2355 (LBL–26612-Vol.1) **The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 1, Text and main figures.** Aunzo, Z.; Bodvarsson, G.S.; Laky, C.; Lippmann, M.J.; Steingrimsson, B.; Truesdell, A.H.; Witherspoon, P.A. Lawrence Berkeley Lab., CA (USA). Aug 1989. 201p. Sponsored by U.S. Agency for International Development; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90003119. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

The Earth Sciences Division of Lawrence Berkeley Laboratory (LBL) is conducting a reservoir evaluation study of the Ahuachapan geothermal field in El Salvador. This work is being performed in cooperation with the Comision Ejecutiva Hidroelectrica del Rio Lempa (CEL) and the Los Alamos National Laboratory (LANL). This report describes the work done during the first year of the study (FY 1988–89), and includes the (1) development of geological and conceptual models of the field, (2) evaluation of the initial thermodynamic and chemical conditions and their changes during exploitation, (3) evaluation of interference test data and the observed reservoir pressure decline, and (4) the development of a natural state model for the field. The geological model of the field indicates that there are seven (7) major and five (5) minor faults that control the fluid movement in the Ahuachapan area. Some of the faults act as a barrier to flow as indicated by large temperature declines towards the north and west. Other faults act as preferential pathways to flow. The Ahuachapan Andesites provide good horizontal permeability to flow and provide most of the fluids to the wells. The underlying Older Agglomerates also contribute to well production, but considerably less than the Andesites. 84 refs.

2356 (LBL–26612-Vol.2) **The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 2, Appendices A through E.** Aunzo, Z.; Bodvarsson, G.S.; Laky, C.; Lippmann, M.J.; Steingrimsson, B.; Truesdell, A.H.; Witherspoon, P.A. Lawrence Berkeley Lab., CA (USA). Aug 1989. 426p. Sponsored by U.S. Agency for International Development; U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002528. Available from NTIS, PC A19/MF A01 - OSTI; GPO Dep.

These are appendices A thru E of the Ahuachapan geothermal field reservoir analysis. The volume contains: mineralogy contours, ionic chlorine and silicon dioxide contours, well summaries, and temperature and pressure effects. (JEF)

1510 Direct Energy Utilization

2357 (EGG-M–88264) **Geothermal direct use projects in the United States: Status and trends.** Lunis, B.C.; Lienau, P.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-881013–5: JIGASTOCK '88: international conference on applied geothermal energy and thermal energy storage, Versailles (France), 18-21 Oct 1988). Order Number DE90002012. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Prior to about 1973, geothermal most direct use projects in the United States involved pool/spa applications and limited district and space heating systems. The oil price shocks of the 1970's revived interest in the use of geothermal energy as an alternative energy source. Accordingly, the US Department of Energy initiated numerous programs that caused significant growth of this industry. These programs involved technical assistance to developers, the preparation of project feasibility studies for potential users, cost sharing of demonstration projects (space and district heating, industrial, agriculture, and aquaculture), resource assessments, loan guarantees, support of state resource and commercialization activities, and others. Also adding to the growth were various federal and state tax credits. The use of groundwater-source heat pumps contributed to the growth, starting in 1980. The growth of direct use project development was quite closely monitored during the late 1970's and early 1980's when the USDOE program activities were extensive. Periodic updating of the status of the projects has been occasional but limited since that time. In order to obtain a better understanding of the current geothermal direct use market, the Oregon Institute of Technology Geo-Heat Center (OIT), under contract to the US Department of Energy, launched an extensive data-gathering effort in the spring of 1988. The results of that effort are incorporated into this paper. The Idaho National Engineering Laboratory (INEL) (also funded by the Department of Energy) and OIT, through their continuing contacts with the geothermal industry, including state energy offices, are familiar with development trends and concerns; this information is also presented. 3 tabs.

1520 Geothermal Data and Theory

2358 (DOE/ER/13711–1) **Anisotropic yielding of rocks at high temperatures and pressures: Technical progress report No. 1, April 15, 1987–April 14, 1988.** Kronenberg, A.K.; Russell, J.E.; Handin, J.; Gottschalk, R.R.; Shea, W.T. Texas A and M Univ., College Station, TX (USA). Center for Tectonophysics. Dec 1987. 44p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER13711. Order Number DE90003047. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Results to date are: All of the starting materials for the three year project have been collected. Included in our collection are relatively fine-grained, fresh, oriented blocks of schist, gneiss, and micaceous quartzite with well-defined foliations and lineations as well as granite blocks oriented with respect to the principal quarrying orientations, the rift, grain, and hardway. A suite of samples has also been collected from an exposed granite stock and surrounding country rocks in order to evaluate the strengths and distribution of fabrics which may be encountered while drilling. These fabrics appear to be directly related to the forceful emplacement of the pluton. The literature on the mechanics of intrusion has been reviewed with regard to strain gradients and foliation development associated with diapiric flow. This information will be used to evaluate flow of varying fabrics on yield criteria within and surrounding magma chambers. Twenty-three successful experiments have been performed on samples of gneiss cored along six different orientations at temperatures ranging from 25° to 700°C. These experiments include extension tests, unconfined compression tests, and compression tests performed at P_c = 100 MPa. Theoretical yield conditions for anisotropic materials have been reviewed and the assumptions upon which they are based probed. These yield conditions will ultimately be used to fit our data on gneiss, and the other foliated rocks under investigation. Two abstracts have been published and oral presentations made at the 1987 Fall Meeting of the American Geophysical Union, based upon our previous DOE-sponsored work on tensile fracturing of quartzite and related work on semi-brittle deformation of granitic rocks. 21 refs., 12 figs., 2 tabs.

2359 (ETDE-mf–0717911) **Reactions and interactions of the reservoir rock with heat exchange media in the hot dry rock process: A case study in the Falkenberg granite.** Althaus, E.; Herold, G. Karlsruhe Univ. (T.H.) (Germany, F.R.). Mineralogisches Inst. [1985]. 31p. (In German). BMFT 03E-6077-A. Order Number DE90717911. Available from NTIS (US Sales Only), PC A03/MF A01.

Mineral and rock, which are the energy carriers of heat storage in hot dry rock systems (HDR), do not behave chemically inertly towards aqueous heat exchange media. Solid-liquid-reactions, which take place in such systems, on the one hand, load the fluids with dissolved substances and, on the other hand, change the rock surfaces serving for the heat exchange. These conditions were investigated by systematic parameter variations in a rock complex with the aim to study the effect and significance of chemical processes in the framework of the overall system. The principal minerals of a granite (quartz, alkali feldspar, plagioclase, biotite) as well as the interaction of several solids (mineral combination) and the reaction conditions (temperature, pH value, concentration of solution, acidity influence, time dependence) were investigated. Conclusions are drawn for the installation and operation of an HDR system in granite. (HWJ).

2360 (SAND–89-0567) **Magma energy extraction: Annual report for FY88.** Dunn, J.C. (ed.). Sandia National Labs., Albuquerque, NM (USA). Aug 1989. 58p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE90002627. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Thermal energy contained in magmatic systems represents a huge potential resource. In the US, useful energy contained in molten and partially-molten magma within the upper 10 km of the crust has been estimated at 50,000 to 500,000 Quads. The objective of the Magma Energy Extraction Program is to determine engineering feasibility of locating, accessing and utilizing magma as a viable energy resource. Engineering feasibility will depend on size and depth of the resource; extraction rates; and material life times. 11 refs., 29 figs., 1 tab.

16 TIDAL AND WAVE POWER

1604 Economics

Refer also to citation(s) 2647

17 WIND ENERGY

2361 (RISO-R–568) **Meteorology and Wind Energy Department annual progress report 1 January - 31 December 1988.** Petersen, E.L.; Skrumsager, B. (eds.). Risoe National Lab., Roskilde (Denmark). May 1989. 48p. Order Number DE90718922. Available from NTIS (US Sales Only), PC A03/MF A01.

The research in the Meteorology and Wind Energy Department is directed towards two major applications: wind energy and modelling air pollution dispersion. In order to maintain a high level of technical competence within these applications, the department has carried

out both theoretical and experimental basic studies. The subjects range from surface energy balance research of the general spatial and temporal structure of atmospheric turbulence to wind engineering investigations of dynamic loads on buildings, bridges, and other structures. Very important parts of the applied work are the testing and licensing of wind turbines for the Danish market and providing consultative services for Danish wind turbine manufactues. (author).

1706 Wind Energy Engineering

Refer also to citation(s) 3137

2362 (ETSU-WN–5063) **WEG MS-2 stall-regulated rotor study.** Wind Energy Group Ltd., Southall (UK); Department of Energy, London (UK); UKAEA Harwell Lab. (UK). Energy Technology Div. 1989. 141p. (WEG–25-4062). Order Number DE90722758. Available from NTIS (US Sales Only), PC A07/MF A01.

Stall-regulation for medium scale wind turbine generators has been studied. The study scope included design and construction of a rotor for installation on the existing MS2 wind turbine generator (WIG) at Ilfracombe. Certain advantages and technical uncertainties associated with stall-regulation have been investigated. Blade design is discussed and the monitoring during commissioning, operation of the rotor, and overspeed protection testing, are reported. (author).

2363 (ETSU-WN–5098) **Adaptive pitch control for power regulation of the MS-2 wind turbine.** Wind Energy Group Ltd., Southall (UK); Department of Energy, London (UK); UKAEA Harwell Lab. (UK). Energy Technology Div. 1989. 107p. (WEG-T–4119). Order Number DE90722759. Available from NTIS (US Sales Only), PC A06/MF A01.

The effectiveness of a previously developed advanced control algorithm, when incorporated into the control system of an actual wind turbine, has been investigated. The purpose of the control algorithm was to improve the action of the pitch control system of a constant speed, full span pitch regulated wind turbine. The pitch control system is used to limit the power output in high winds. The work involves: (a) specifying and selecting an appropriate microprocessor based hardware system on which to implement the control algorithm; (b) programming the new system to enable it to carry out all the functions of the old controller safely and reliably, and installing, commissioning and testing it on the MS2 wind turbine near Ilfracombe, Devon; (c) programming the new system with the new control algorithm, after modifying it to cope with various constraints imposed by the hardware; and (d) testing and monitoring the performance of the new algorithm, analysing the results, and using them to develop and improve the algorithm. (author).

2364 (NEI-DK–214) **Windmills standing on the sea bed at Dvalegrunden. Draft project.** Hoffmann (H.) og Soenner A/S, Gentofte (Denmark); Havnecon Consulting A/S, Lemvig (Denmark); Vind-Syssel A.M.B.A., Jerslev (Denmark). May 1989. 83p. (In Danish). Order Number DE90718986. Available from NTIS (US Sales Only), PC A05.

A feasibility study produced by a Danish firm that manufactures windmills, an entreprenour/civil engineering firm, and a consulting civil engineering firm in collaboration, relating to the possible construction of a wind turbine array on an offshore site. The geological, wave force and ice conditions are investigated and the construction proceedures are described in detail. A cost-benefit analysis is presented and a detailed description of the wind turbines design has been contributed by the manufacturer in question. The text is illustrated with diagrams, maps, tables and charts. (AB).

2365 (NEI-DK–221) **Joint action on aerodynamics of wind turbines.** Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. 255p. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

As part of the joint action on Aerodynamics, which is one of the activities covered by Annex XI to the IEA; R and D, WECS implementing agreement, a two day symposium on the Aerodynamics of Wind Turbines has been organized. These proceedings are the outcome of this second symposium, which was held in Denmark 21. and 22. November 1988. The symposium was attended by 20 researchers from 7 of the signatory countries, and 15 presentations were given. The attendance was restricted to people actively doing research within the field, hence assuring active participation in the presentations and discussions. In the invitation to the symposium the following topics were suggested, calculational methods and experimental results for rotors in yaw, new airfoil sections, status and prospects and 3-d flow through rotors. Calculational methods and experimental results, flow at or near stall conditions in particular. It was apparent, that the first topic was of most interest, and that several parties were going to embark on projects addressing that problem. It was agreed that participating institutions should try to inform each other on ongoing and planned projects, in order to enhance coordination and collaboration. (AB).

2366 (NEI-DK–221, pp. 4-27) **Some physical and numerical aspects of wind turbine aerodynamics.** Noerkaer Soerensen, J. (Dept. of Fluid Mech., Techn. Univ. of Denmark, Lyngby (DK)). Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines*. Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

In the paper the problem of determining the influence of rotation on the boundary layer of blades of wind turbines is addressed. To distinguish this problem from other factors which may alter the airfoil characteristics, we assume the blade be infinite and the inflow steady. In fact, such a problem is not feasible in nature, but can be treated analytically or numerically on a computer. Equations defining the mathematical problem are shown, and some physical interpretations of the terms which may alter the two-dimensional characteristics of airfoils submitted to rotation are given. A rotating flat plate and a blade rotating with constant incidence on which the boundary layer everywhere is separated from the upper surface are analytically investigated. A brief description of mathematical and numerical features of the boundary layer equations in order to establish the basis for general viscous-inviscid calculation procedures is given. Finally, a short description and some results of the viscous-inviscid interaction model developed by the author (Soerensen, 1986) is presented. (AB) 32 refs.

2367 (NEI-DK–221, pp. 38-55) **Actuator disc edge singularity. The key to a revised actuator disc concept and momentum theory.** Kuik, G.A.M. van (The Wind Energy Group of the Technical University Eindhoven (NL)). Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines*. Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

Since the beginning of rotor aerodynamics the actuator disc momentum theory occupies a prominant place in almost any textbook on this subject. Specially in axial flow the theory provides an easy and rather accurate performance prediction. The results first obtained by Lanchester for the induced power of a hovering rotor and the maximum power of a wind turbine are still used as guidelines for complicated calculations. On the other hand, experimental results for propellers are known to deviate systematically (some 10%) from the momentum theory results. This is commonly attributed to the differences between a real rotor and an actuator disc. However, some actuator disc- and actuator strip (the 2-dimensional version) experiments are described in literature, showing the same deviations from momentum theory results. Therefore, apart from the question how representative an actuator disc is for a real rotor, the actuator disc concept itself may be inadequate. This problem is the subject of the work describe here. It will be shown that the classical actuator disc concept ignores discrete forces resulting from a flow singularity at the edge of the disc. The (extended) momentum theory, applied to this actuator strip model, shows a shift of the results

towards the experimental data, and for the static case (hover) even a quantitative agreement is obtained. (author) 12 refs.

2368 (NEI-DK–221, pp. 56-70) **Performance methods (again—).** Montgomerie, B. (The Aeronautical Research Institute of Sweden (SE)). Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

The possibilities are examined of being able to continue using the type of method for performance/force calculation that is now generally being applied, with modifications. The attraction in blade element/momentum theory lies in the simplicity and speed of calculation. This should be viewed in comparison with vortex wake representation, which take up considerable computer time. The measurements were conducted in a low speed wind tunnel at KTH, The Royal Institute of Technology, in Stockholm. The models had a diameter of 25 cm suggesting that extreme care should be taken when Reynold's number (Re) effects are important and the data is to be used for larger machines. The shaft torque was absorbed by a small generator with a controllable dump load device allowing the desired RPM and/or power extraction. In the cases studied here the power coefficient was about 0.35. The wake was traversed with hot wire probes allowing the wake cross section to be mapped in detail concerning velocity and turbulence intensity. The main purpose of the investigation at KTH was to assess the wake speed deficiency for wind turbine clusters where the important issue is wake speed recovery and turbulence. In performance calculations the so called tip correction factor depends strongly on the helix angle assumed. T.Theodorsen, in this "Theory of Propellers", McGraw-Hill 1948, suggests that all geometry pertinent to be propeller can more conveniently be referred to the "Trefftz' Plane". Applying this idea to a wind turbine means that the apparent tip speed ratio (or helix angle) in the wake be used in place of the nominal tip speed ratio. The conclusion from some numerical exercises suggests that the tip speed ratio taken at the disk, gives better agreement with measurements. The singular tip vortex may be used, rather than some screw surface form which induction emanates. (AB).

2369 (NEI-DK–221, pp. 71-88) **Two simple models for dynamic inflow.** Snel, H. (Netherlands Energy Research Foundation, ECN (NL)). Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

It was shown that the aerodynamic damping as predicted by the momentum-blade element theory, depends substantially on the implementation (frozen wake or equilibrium wake). It was also argued that this theory is not easily adaptable to unsteady inflow calculations. Two simple models are proposed for the dynamic inflow of a windturbine, one in integral, one in differential form. Both models are made to have the same steady solution as the momentum-blade element method. Neither model has been tested by the author. They are proposed as food for thought at the IEA Symposium on HAWT aerodynamics. (author).

2370 (NEI-DK–221, pp. 89-96) **Aerofoil design and testing.** Bussel, G.J.W. van (Institute for Windenergy, Delft University of Technology, Delft (NL)). Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

Stall regulated windturbines in the Netherlands are often equiped with Stork WPS blades, or a similar design, using NACA 4412 to NACA 4424 aerofoils. In a study to improve the characteristics of stall regulated windturbines a search has been made towards sections having a laminar flow over a larger portion of the aerofoil. Laminar flow will diminish the drag coefficient and therefore improve the lift to drag ratio. Little is known of the characteristics of aerofoil having a relative thickness of above 18%. Based upon a classical series of laminar aerofoils, also used already in the windturbine industry, a thick aerofoil has been designed and tested. The results were quite astonishing. They gave the impression that the scant material available on thick aerofoils is seldom measured correctly. Measured values for the maximum lift coefficient using pressure holes in the model were larger than expected. Roughness turned out to be fatal for the aerofoil tested. (AB).

2371 (NEI-DK–221, pp. 104-121) **Wind tunnel tests of airfoil sections extended to high angles of attack.** Rossi, E. (ENEA (IT)); Massini, G.; D'Angelo, S. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

Wind tunnel tests of 6 commercially produced airfoil sections extended to high angles of attack in order to determine aerodynamic characteristics and pressure distribution. Methods and results are illustrated by diagrams and graphs. (AB).

2372 (NEI-DK–221, pp. 150-159) **Derivation of three-dimensional airfoil data on the basis of experiment and theory.** Aagaard Madsen, H. (The Test Station for Windmills, Dept. of Meteorology and Wind Energy, Risoe National Laboratory, Roskilde (DK)); Rasmussen, F. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

It is well-known that the direct use of 2D wind tunnel airfoil data as input to an ordinary strip theory performance code does not yield results in satisfactory agreement with experiment. Combined with the standing requirement of operational tools for rotor design, this has led to the development of different synthesizing techniques, during which so-called 3D airfoil data are derived on an experimental/emperical basis. At The Test Station for Windmills, Risoe, such a synthesizing technique has been developed and now used on more rotors. An experimental data base for the NACA 63_n-2nn airfoil, originating from measurements on rotors with diamters 17 m, 19 m, and 22 m, show considerable deviations when compared with 2D data. The trend of the deviations are (1) increased maximum lift CL_{max} close to the hub; (2) reduced slope of the lift curve for the sections close to the tip and (3) reduced CD at high angle of attack. (author).

2373 (NEI-DK–221, pp. 160-167) **Location of flow separation on an 11 m wind turbine blade by means of flow visualization and a two dimensional airfoil code.** Friis Pedersen, T. (The Test Station for Windmills, Dept. of Meteorology and Wind Energy, Risoe NatioLaboratory, Roskilde (DK)); Aagaard Madsen, H. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

The lack of knowledge about the nature and behaviour of the three-dimensional airflow past a stalled wind turbine blade has led to the present study. An 11 m wind turbine blade was fitted with tufts, which were visualized with the use of a video camera, mounted on the root of the blade. Pictures at wind speeds from 12 to 18 m/s were recorded together with recordings of blade bending moments in four different radii. The video pictures show that the tufts clearly respond on the local flow separation. The development

of the stall in radial direction as a function of the wind speed is not clearly detectable, but some general patterns are found. A pronounced parameter dominating the flow separation is the blade azimuth position. During one rotor revolution the separation point can move from positions close to the trailing edge to the leading edge and back again. The visualized flow separation is compared with calculations by a strip theory/blade element code and a two dimensional profile code. For a specific rotor rotation good correlation was found between visualized and calculated separation. In general, though, the observed chordwise movement of the separation points was greater than calculated. (author).

2374 (NEI-DK–221, pp. 168-178) **On the usefulness of surface pressure calculations with a panel method for wind turbines.** Meijer, S. (FFA, Bromma (SE)). Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

In a recent paper on three-dimensional calculations of wind turbine surface pressures it was stated that the discrepancies between measured blade forces and forces calculated with so called Blade-Element Theory (BET) are due to inviscid effects. The use of BET gave too small blade forces even at low angles of attack while the use of a panel method gave blade forces that were in better agreement with experiments. The wake geometry in the panel method was prescribed. In order to demonstrate the effects of different assumptions about the wake geometry I have carried out calculations with a panel program for a wind turbine with two blades at three different tip speed ratios (TSR), 4, 8 and 16. The blade profiles are from the NACA44 series. The results are compared with results from the program WINRO, which is based on BET and uses Prandtl's correction for the tip loss. Calculated invicid two-dimensional profile data were used in WINRO. (AB).

2375 (NEI-DK–221, pp. 186-203) **Design of aerofoils for wind turbine use.** Hill, D.C. (Garrad Hassan and Partners, London (GB)); Garrad, A.D. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

At present wind turbines use conventional aircraft aerofoils. The most common are old NACA sections 44xx, 230xx and 64_3 series. More recently the general aviation aerofoils, now known as LS-1 and LS-1 Mod, have received a great deal of attention and are increasingly used on new blades. The flow encountered by a wind turbine is sufficiently different to that encountered by a fixed wing aircraft to merit consideration of the design of aerofoils specifically for wind energy use. The work reported here is taken from a project undertaken on a UK Department of Energy project, E/5A/CON/5107/1843, aimed at performing that task for horizontal axis, pitch regulated machines. The only data published on this topic is the work undertaken by Tangler and Somers in the USA. Their remit was different from ours in that their work was aimed directly at small, stall regulated machines. (author).

2376 (NEI-DK–221, pp. 128-142) **Results from actuator surface theory applications on wind turbine rotors.** Aagaard Madsen, H. (The Test Station for Windmills, Risoe National Lab., Roskilde (DK)). Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

The main subject of the paper, is an extension of the plane actuator-disc concept to comprise an actuator surface of arbitrary shape as proposed by MADSEN (1985). The starting point of the derivation will be based on the physical conditions in a real rotor, thus revealing the relationship that was missing in the original definition of the actuator disc. On the basis of the general actuator surface it is shown that the Betz limit is not unique for different types of wind turbines. A numerical example for a straight-bladed vertical-zxis wind turbine shows that the Betz limit can probably be exceeded. The governing system of equations for the three-dimensional flow through an actuator surface is described and a possible method of solution is sketched. Results from the solution of the two-dimensional flow problem are then shown for two different actuator surfaces, the original plane actuator disc and an actuator cylinger. For the former, only the linear solution is outlined together with the classical and commonly used momentum theory solutions. We address the limitations of the momentum theory and their consequences as we deal here with a calculation method widely used in industry and research. The results from applications of actuator surface theory on wind turbine rotors illustrated by a number of graphs. (AB).

2377 (NEI-DK–221, pp. 210-224) **Airfoil design for horizontal axis wind turbines.** Bjoerck, A. (FFA, The Aeronautical research institute, FFA Aeronautics Lab. at KTH, Stockholm (SE)). Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

The interest in tailor made airfoils for Wind Turbines has lately increased. At FFA work is beeing done to develop new airfoils for Horizontal Axis Wind Turbines, HAWTs, within the FFA Basic Wind Energy Research program. A discussion of the desirable characteristics of airfoils for HAWTs is given and the design philosophy for a suggested 15.2% thick airfoil for the outer parts of turbine blade will be presented. Suggested thicker airfoils for the inner blade is also presented. (author) 16 refs.

2378 (NEI-DK–221, pp. 231-253) **Experimental investigations of the rotor loads and the rotor-induced flow of a two-bladed wind turbine model in the low speed wind tunnel of DLR.** Wagner, W.J. (DLR Institute of Aeroclasticity, Goettingen (DE)); Deppe, L. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. (CONF-8811284–: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). In *Joint action on aerodynamics of wind turbines.* Order Number DE90719162. Available from NTIS (US Sales Only), PC A12.

IEA, R and D, WECS.

The periodically changing flow field in the rotor plane and in the wake of the rotor were measured on the GROWIAN wind turbine model (scale 1:25) as well as the circulation distribution of the blades. To this end an ultrasonic traveltime measuring device was developed with a maximum sample rate of 1250 per second. The measured flow fields are shown as 3-D-pictures allowing detailled insight into the time/space behaviour of the flow. The direct measurement of circulation is used to evaluate the lift distribution of the rotating blade. These results show good agreement with theoretically calculated lift distributions. (auuthor) 10 refs.

2379 (NEI-DK–222) **Joint action on aerodynamics of wind turbines. Supplement.** Maribo Pedersen, B. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik; International Energy Agency, 75 - Paris (France). 1989. 15p. (CONF-8811284–Suppl.: 2. symposium on aerodynamics of wind turbines, Lyngby (Denmark), 21-22 Nov 1988). Order Number DE90719250. Available from NTIS (US Sales Only), PC A03.

IEA, R and D, WECS.

As part of the joint action on aerodynamics, which is one of the activities covered by Annex XI to the IEA, R and D, WECS implementing agreement, a two day symposium on the Aerodynamics of Wind Turbines has been organized. These proceedings are the outcome of this second symposium, which was held in Denmark 21. and 22. November 1988. The symposium was attended by 20 researchers from 7 of the signatory countries, and 15 presentations were given. The attendance was restricted to people actively doing

research within the field, hence assuring active participation in the presentations and discussions. In the invitation to the symposium the following topics were suggested, calculational methods and experimental results for rotors in yaw, new airfoil sections, status and prospects and 3-d flow through rotors, calculational methods and experimental results, flow at or near stall conditions in particular. It was apparent, that the first topic was of most interest, and that several parties were going to embark on projects addressing that problem. It was agreed that participating institutions should try to inform each other on ongoing and planned projects, in order to enhance coordination and collaboration. (AB).

2380 (NEI-DK–228) **Noise from larger windmills. Principles for the construction of windmills that produce less noise.** Andersen, B.; Jakobsen, J. DK-Teknik, Soeborg (Denmark); Lydteknisk Inst., Taastrup (Denmark). Jun 1988. 48p. (In Danish). Order Number DE90719297. Available from NTIS (US Sales Only), PC A03/MF A01.

Prepared for ELKRAFT.

The nature and causes of noise pollution from larger windmills are discussed in special relation to generators, gears, and hydraulic and ventilation systems. Following this the construction of the tower and the machine housing are described and a specific example of a Danish-produced wind turbine is presented in detail. (AB) 12 refs.

2381 (PNL-SA–17250) **Detailed analysis of the wake and free-flow characteristics at the Goodnoe Hills MOD-2 site.** Elliott, D.L.; Barnard, J.C. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-890981–4: Windpower '89, San Francisco, CA (USA), 24-27 Sep 1989). Order Number DE90002725. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Wind data collected on meteorological towers at the Goodnoe Hills MOD-2 wind turbine site were analyzed to characterize the free wind turbine wakes over the site. Free-flow characteristics examined were the variability of wind speed and turbulence intensity across the site as a function of wind direction. Scattered areas of trees upwind of the site caused pronounced variations in the wind flow over the site. A substantial increase in the turbulence, as well as a considerable decrease in the mean wind speed, was observed when a tower was downwind of the trees. Wind turbine wake characteristics analyzed included the average velocity deficits, wake turbulence, and the vertical profile of the wake. Wake behavior downwind of the turbines was analyzed at distances from 2 to 10 rotor diameters (D). The relationship between velocity deficit and downwind distance was surprisingly linear. Largest deficits were at low wind speeds and low turbulence intensities. Wake turbulence was greatest along the flanks of the wake, and the vertical variation of deficits was greater below hub height than above. 1 ref., 6 figs.

2382 (RISO-M–2795) **Generation of fatigue loads on Windane 40/2.** Voelund, P.; Rasmussen, F. Risoe National Lab., Roskilde (Denmark). Jun 1988. 49p. (In Danish). Order Number DE90718936. Available from NTIS (US Sales Only), PC A03/MF A01.

The report contains a new calculation method for generation of dynamic load spectra for wind turbines. The deterministic and stochastic loads are calculated separately and added in the time domain. The load spectra are found by rainflow-counting on the generated time series. Based on the load spectra calculation of fatigue life are carried through according to the Palmgreen-Miner's rule of damage accumulation. In the report the method is exemplified by calculation of the dimensioning fatigue loads in flapwise direction in the blade root of a pitch-regulated Windane 40/2 for the Masnedoe Windfarm. Equivalent analysis of a limited amount of data measured on the Masnedoe wind turbines are carried through. The measurements confirms the calculated results. (author) 33 ills., 4 refs.

2383 (SERI/STR–257-3479) **Computer simulation of wind/diesel system operation.** Solar Energy Research Inst., Golden, CO (USA); AeroVironment, Inc., Monrovia, CA (USA); Integral Technologies, Inc., Westmont, IL (USA). Sep 1989. 100p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009445. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This document reports on a computer code, SOLSTOR W/D, that determines — for a site's wind energy resources, load requirements, and economic constraints — the components and sizes for a wind/diesel system that result in the lowest cost of energy. Wind diesel systems are defined here as electricity generation stations in the 50-kW to 1-MW range that (1) are not connected to another electricity network, (2) use wind energy as the first source of supply to meet demand, and (3) contain sufficient energy storage and/or backup diesel electric generators to compensate for lapses in wind energy. The computer code also determines, for the same input load, the requirements and economics that are the best number and size for an isolated diesel(s) system so that comparisons for wind/diesel systems and diesel-only systems can be made. SOLSTOR W/D provides a systematic method to show whether wind-diesel systems can be an attractive means of saving fossil fuel without significantly affecting electricity quality or production cost. 12 refs., 66 figs., 5 tabs.

2384 (SERI/TP–257-3591) **An initial look at the dynamics of the microscale flow field within a large wind farm in response to variations in the natural inflow.** Kelley, N.D. Solar Energy Research Inst., Golden, CO (USA). Oct 1989. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-890981–3: Windpower '89, San Francisco, CA (USA), 24-27 Sep 1989). Order Number DE89009501. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses some early results from a study to examine the influence of the natural inflow structure on the internal microscale turbulence environment of a large wind farm. Two fully equipped, high-resolution boundary layer measurement systems were employed to document the alteration of the turbulent structure as the flow entered and left a wind park consisting of 41 rows of turbines. These systems collected data continuously for a period of several weeks during the peak wind season in San Gorgonio Pass. In addition, statistical summaries of the inflow and outflow characteristics from a hub-height elevation were recorded prior to, during and after the detailed measurement period. Results of these hub-height summaries will be discussed and interpreted in this paper. 11 figs.

2385 (SL–1251-85195-20) **Power mesurements on a 99 kW "Smedemoelle" wind turbine, erected at Hasle, Bornholm.** Jensen, S.A.; Kristensen, J.W. Skibsteknisk Laboratorium, Lyngby (Denmark). Apr 1986. 45p. (In Danish). Order Number DE90719284. Available from NTIS (US Sales Only), PC A03/MF A01.

This project contains results from field measurements carried out on a 99 kW "Smedemoelle" wind turbine. The hub height is 24 m. The 99 kW "Smedemoelle" is a horizontal axis turbine with a 3-bladed, upwind rotor. The diameter of the rotor is 21 m. The test programme has given information about the electrical power output from the wind turbine as a function of the wind speed at the hub height, the total efficiency of the wind turbine as a function of the wind speed at hub height and the annual energy production of the wind turbine under different wind conditions. The power curve and the total efficiency curve are shown in the form of graphs. Some further measurements were carried out with the purpose of investigating the power curve for different cut-in and cut-out wind speeds for the generators. These further measurements have given information about the electrical power output from the wind turbine as a function of the wind speed at hub height with only the large generator in operation and the electrical power output from the wind turbine as a function of the wind speed at hub height with only the small generator in operation. The power curve with the large generator in operation and the efficiency curve with only the large generator in operation are illustrated by graphs. (AB).

2386 (STEV-VIND–89-17) **Evaluation of the relation (coherence) between wind speed and various set parameters at the Naesudden wind power plant.** Thor, S.E.; Ahlin, K. Statens Energiverk, Stockholm (Sweden); Flygtekniska Foersoeksanstalten, Stockholm (Sweden). 15 Nov 1988. 22p. (In Swedish). (FFAP-A–778). Order Number DE90719438. Available from NTIS (US Sales Only), PC A03/MF A01.

Three long-range campaigns at the Naesudden wind power plant were evaluated in order to study in what frequency region there is good agreement (coherence) between wind velocity and power. The coherence exceeds 0.50 at frequencies lower than ca. 0.03Hz (33

seconds). Similar results are obtained for the other signals. By frequencies above ca. 0.1Hz the load upon the plant is on the whole dependent on the dynamic properties of the structure. Loads from wind shear will however produce higher frequencies than 1 Hz.

2387 Proceedings of the eighth ASME wind energy symposium. SED-Vol. 7. Berg, D.E. Klimas, P.C. 302p. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

This book is composed of the proceedings of the Eighth ASME Wind Energy Symposium. Topics covered include: Wind inputs, wakes and array effects; Aerodynamics; Structural dynamics, Power systems I and II; Systems and system dynamics; and Testing of wind systems and components.

2388 Advances in three-dimensional turbulence measurement capability. Connell, J.R. (Pacific Northwest Lab., Richland, WA (USA)); Morris, V.R. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Requirements for three-dimensional turbulence velocity measurements for wind turbine purposes have recently led to advances in anemometer accuracy and resolution, particularly for situation when the angle of the wind relative to the anemometer axis is large. New precision calibration data for a complete three-dimensional UVW propeller anemometer are presented. Repeatability of calibration data and comparison with previous calibrations are shown. Special attention is given to the calibration of the crosswind components, V and W.

2389 Estimation of turbulence variance and scale, simplified for wind turbine applications. Powell, D.C. (Pacific Northwest Lab., Richland, WA (USA)). vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

A simplified method is presented for estimating onsite turbulence variance within the wind turbine layer for horizontal wind speed. The method is based principally on estimating the probability distribution of wind speed and assigning a variance to each mean wind speed based on surface roughness estimates. A revision of the Kaimal neutral u-component spectrum is suggested to apply to the mix of the stabilities occurring during operational winds. Values of integral length scale calculated from data analysis are shown to contradict the length scale model implicit in turbulence power spectra. Also, these calculated values are shown to be extremely sensitive to the length of the time series and the detrending method used.

2390 Effect of turbulence scale on VAWT aerodynamic response. Homicz, G.F. (Sandia National Labs., Albuquerque, NM (USA). Aerodynamics Dept.). vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

The size of the DOE/Sandia 34 m VAWT Test Bed recently erected in Bushland, Texax necessitates that variations in turbulence in the crossflow planes, i.e., across the face of the rotor, be included in any simulation. Accordingly, the earlier model had been modified to incorporate a full 3-D turbulence simulation. The incorporation of flow retardion effects, i.e., the fact that the reduction in mean flow velocity across the rotor reduces the rate at which the turbulence is convected through it, will also be discussed. The aerodynamic response model is the same as that used earlier, and includes the effects of Reynolds' number variation, discontinuous changes in airfoil section/chord, and the numerical results are presented to illustrate the effects of varying the ratio of turbulence scale (both streamwise and transverse) to rotor size. Preliminary comparisons between the model's predictions and data from the 34 m Test Bed are discussed. Finally, a simple formula is postulated for predicting the influence of turbulence on average output power, which does not require use of a full stochastic simulation.

2391 Finite difference analysis of the three dimensional flow field of a vertical axis wind turbine. Rajagopalan, R.G. (Iowa State Univ. of Science and Technology, Ames, IA (USA). Dept. of Aerospace Engineering); Klimas, P.C. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

The performance of a three dimensional vertical axis wind turbine in laminar flow field is analyzed using an elliptic finite difference procedure known by the name SIMPLER. The conservation equations of mass and momentum are solved using a primitive variable approach wherein the primitive variable p (static pressure), u (component of velocity in the i-direction), and w (component of velocity in the k-direction) are solved for directly. The motion of the blades are time averaged and introduced through the source terms of the momentum equations. Performance characteristics such as power coefficient and normal and tangential force coefficients are computed and compared with experimental results and other theoretical methods.

2392 Prediction of stochastic blade responses using measured wind speed data as input to the FLAP code. Wright, A.D. (Solar Energy Research Inst., Golden, CO (USA)); Thresher, R.W. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

The objective of this paper is to show FLAP code predictions compared to measured blade loads, using actual anemometer array data and a curve-fitting routine to form series expansion coefficients as the turbulence input to FLAP. Three 10-min data cases are used to compare FLAP predictions to measured results. Each case represents a different mean wind speed and turbulence intensity. The time series of coefficients in the expansion of the turbulent velocity field are input to the SLAP code. Time series of predicted flapbending moments at two blade radial stations are obtained, and power spectra of the predictions are compared to power spectra of the measured blade bending moments. Conclusions are drawn about the FLAP code's ability to predict the blade loads for these data cases. Recommendations for future work are made.

2393 Prediction of stochastic blade responses using a filtered noise turbulence model in the FLAP code. Thresher, R. (Solar Energy Research Inst., Golden, CO (USA)); Wright, A.D.; Holley, W.E. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

The time-domain model described in this paper uses a random number generator to construct a whit-noise time series with uniform spectral density over the frequency range of interest. This signal is then filtered to obtain the various wind fluctuations, which are used as input to the FLAP code. This requires as input only the mean wind speed, the turbulence intensity, and an estimate for the integral scale. The modeling is based on the assumptions that the velocity fluctuations are statistically stationary, homogeneous, and isotropic, and satisfy Taylor's frozen field hypothesis. The von Karman model is used to characterize the correlation between velocities of points separated in space. To gain insight into the usefulness of this turbulence simulation for predicting stochastic turbine loads, the Flap code was used to model three data cases from the 1986 testing done on the Howden 330-kw turbine.

2394 VAWT dynamic stall models revisited. Berg, D.E. (Sandia National Labs., Albuquerque, NM (USA)). vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Many VAWT aerodynamic loads codes incorporate the Gormont (or Boeing-Vertol) dynamic stall model. The model is relatively simple and easy to implement, and (in conjunction with the Masse' correction), it produces results which quite accurately predict the overall performance of a variety of VAWTs. The Gormont model, however, was developed for helicopter applications and was based on data from thin airfoils that underwent relatively small oscillations in angle of attach about the static-stall angle of attack. In the VAWT application, it is used to model the behavior of thick airfoils (15-21%) undergoing large oscillations (+/- 30-40^0) about zero angle of attack. All of us who have used this model have had some reservations about using it in this context. However, its use produced good agreement with measured data and little or no dynamic data have been available for appropriate airfoil sections with time histories approximating those experienced by VAWT blades. Ohio State University has developed a database of static and dynamic lift data for the NACA 0021 (with and without vortex generators) and SAND 0018/50 airfoils, both of which are used on VAWTs. They are in the process of analyzing this data and attempting to develop a semi-empirical dynamic stall correlation that will yield a relatively accurate representation of that data without requiring excessive amounts of computer time or storage. This presentation presents comparisons of the Gormont model predictions and measured data and discusses the progress that has been made in achieving an improved dynamic-stall correlation for VAWT application.

2395 **Three-dimensional wind simulation.** Veers, P.S. (Sandia National Labs., Albuquerque, NM (USA)). vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

A method for numerically simulating a three-dimensional field of turbulent wind-speed (the "Sandia method") for use in the aerodynamic and structural analyses of wind turbines is presented. The required inputs are single point power spectral densities (PSDs) and the coherence function. Suggestions for appropriate inputs and an example calculation are included. The simulation method is used to obtain "rotationally sampled" PSDs, which are compared with measurements obtained by Pacific Northwest Laboratories. The results show that the Sandia method is capable of producing simulations that agree with the measurements, especially when the coherence function is augmented from the usual form to include the ratio of spatial separation over height, raised to the 0,25 power. The method is specialized for horizontal axis wind turbine analysis.

2396 **Fatigue characterization of a VAWT blade material.** VanDenAvyle, J.A. (Sandia National Labs., Mechanical Metallurgy Div., Albuquerque, NM (US)); Sutherland, H.J. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

The fatigue analysis of Wind Energy Conversion System blades has been limited by the lack of fatigue data for typical blade materials, including 6063 aluminum, an alloy commonly used for Vertical Axis Wind Turbine (VAWT) blades. This paper reports results to date of a testing program to establish a fatigue properties database for this alloy. Two types of fatigue response data were measured: stress versus number of cycles to failure (S-n) and fatigue crack growth rates. S-n experiments have been conducted on 6063 aluminum blade extrusion material using approximately 100 bend specimens cycled at five alternating stress amplitudes and at four mean stress levels. Data have been analyzed using an equivalent alternating stress based on Goodman's rule to describe mean stress effects on fatigue life. Cyclic crack growth rates have been measured using three loading ratios.

2397 **Simplified fatigue damage and crack growth calculations for wind turbines.** Veers, P.S. (Sandia National Labs., Wind Energy Research Div., Albuquerque, NM (US)). vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Estimating fatigue life of wind turbine components, where the loading and structural response are random, can be a difficult task. The life estimate is sensitive to rare large loads and can be influenced by the sequence of load applications. Sequence effects in fatigue crack initiation and crack growth are outlined. A simplified model for sequence effects in crack growth is presented along with model predictions of an American Society for Testing and Materials (ASTM) crack growth test series. The relative importance of including these effects in fatigue calculations is discussed. Analytical solutions for the time to crack initiation and crack growth provide quick estimates of fatigue life by approximating the loading as a narrow-band Gaussian process and by neglecting sequence effects. This approximation is both conservative and within the usual scatter in fatigue life estimates due to material variability. It is therefore a useful tool in estimating fatigue life, especially when turbine response data is limited.

2398 **Crack propagation analysis of WECS components using the LIFE2 computer code.** Sutherland, H.J. (Sandia National Labs., Wind Energy Research Div., Albuquerque, NM (US)); Schluter, L.L. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

The LIFE2 code is a fatigue/fracture analysis code that is specialized to the analysis of wind energy conversion system components. The code was originally developed by Sutherland, Ashwill and Naassan. It is a PC-compatible Fortran code that is written in a top-down, modular format. This paper discusses the additions to the code that permit WECS components to be analysed using linear fracture mechanics. To illustrate the capabilities of the numerical techniques employed here, two example problems are presented.

2399 **Development of the University of Massachusetts wind/diesel simulator.** Stein, W. (Massachusetts Univ., Amherst, MA (USA). Dept. of Mechanical Engineering); Manwell, J.; McGowan, J.; Rogers, T.; Jones, M.; Jeffries, W. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

A description of the wind/diesel simulator recently developed at the University of Massachusetts is presented in this paper. This system consists of a wind turbine simulator, a phase controlled rectifier DC drive, a simulated load, a frequency controlled dump load, a 15 KW synchronous generator driven by a 40 hp diesel engine, and associated controls and instrumentation. Details of the wind turbine simulator control dynamics are given including the governing analytical relationships for the systems control schemes. The analytical results include a discussion of the system validation including power curve testing plus a determination of the dynamic response of the system. The dynamic response validation included a step test as well as the calculation of the power spectral density for an input wind speed series and the wind turbine generator. In addition, a summary of the experimental results for an initial simulation run of the wind/diesel simulator system is given.

2400 **A case study of a no storage wind/diesel system: Block Island.** . Manwell, J.F. (Massachusetts Univ., Amherst, MA (USA). Dept. of Mechanical Engineering); McGowan, J.G.; Jeffries, W.; Kirchhoff, R. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Recent worldwide interest in wind/diesel hybrid systems has generated a need for reliable data sets from full-sized operational systems. One of the configurations of practical interest, especially for larger sized applications, is the no storage type system. This paper presents a summary of the work from a recent research program carried out using previously unpublished work from the NASA/DOE MOD-OA wind turbine installation with the diesel powered grid

of the Block Island Power Company. In addition to a general overview of the Block Island project and the operations of the Block Island Power Company, this paper reviews the experimental results published in previous technical reports/papers on the subject. In addition to technical conclusions from this analysis, the paper also contains recommendations for future analysis work using this unique set of wind/diesel system data.

2401 Time domain structural response calculations for vertical axis wind turbines. Dohrmann, C.R. (Sandia National Labs., Albuquerque, NM (USA). Applied Mechanics Div. III); Veers, P.S. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Structural response of Vertical Axis Wind Turbines (VAWTs) during transient events such as starting and stopping or during variable speed operation cannot be estimated with existing frequency domain techniques. Time domain simulation is presented, including the effects of changes in rotation speed on turbine response. The method for predicting the structural response of VAWTs during variable speed events differs from that used to analyze constant speed operation in two ways: the equations of motion no longer have constant coefficients and additional terms contribute to the stiffness matrix and loading vector. The structural matrices are obtained at several discrete rotor speeds using NASTRAN and interpolated for intermediate speeds. The equations of motion are then numerically integrated in a separate program. Results for constant speed operation in turbulence-free winds agree favorably with those from a frequency domain analysis.

2402 Aerodynamic pressure and flow-visualization measurement from a rotating wind turbine blade. Butterfield, C.P. (Solar Energy Research Inst., Golden, CO (USA)). vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Aerodynamic, load, flow-visualization, and inflow measurements have been made on a 10-m, three-bladed, downwind, horizontal-axis wind turbine (HAWT). One objective of this comprehensive research program was to study the effects of blade rotation on aerodynamic behavior below, near, and beyond stall. To this end, flow patterns are presented here that reveal the dynamic and steady behavior of flow conditions on the blade. Pressure distributions are compared to flow patterns and two-dimensional wind tunnel data. Separation boundary locations are shown that change as a function of spanwise location, pitch angle, and wind speed.

2403 Liquid-crystal, shear-stress-visualization experiments on a horizontal axis wind turbine. Reda, D.C. (Sandia National Labs., Albuquerque, NM (USA)); Butterfield, C.P. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

A diagnostic technique capable of visualizing the instantaneous surface shear stress pattern in dynamic flow fields, in a continuous and reversible manner, would prove to be a valuable research tool. The potential of liquid crystals to meet this objective has been under investigation at Sandia National Laboratories. A description of the technique and results obtained to date are given. This paper discusses a cooperative research effort was jointly conducted by Sandia National Laboratories and the Solar Energy Research Institute to investigate the feasibility of applying the liquid crystal technique to horizontal axis wind turbines operating in field environments. These liquid-crystal tests were conducted on a three-bladed, downwind, variable-pitch, zero-yaw machine which incorporated the SERI-S809 constant-chord/zero-twist airfoil. In this paper, the technical feasibility and viability of the liquid-crystal technique in WECS field environments is further demonstrated.

2404 A comparison of results from dynamic-response field tests. Hock, S.M. (Solar Energy Research Inst., Golden, CO (USA)); Thresher, R.W.; Wright, A.D. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC02-83CH10093. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

The dynamic response of Howden's 330-kW horizontal-axis wind turbine (HAWT) and the Northern Power Systems 100-kW North Wind 100 HAWT has been measured. This paper presents the results from each of these test programs in an effort to compare the dynamic response of each turbine. The analysis focuses on rotor bending loads in terms of both time domain and frequency response. The FLAP code is used to explore sensitivity to teeter stiffness and natural frequency placement to provide a better understanding of the differences in behavior caused by configuration alone. The results are presented in the form of normalized azimuth-average plots of the deterministic loads, and spectral density plots of the stochastic responses. This presentation of the results contrast major response differences due to design configurations.

2405 Preliminary results from the fatigue testing of northern power systems 100KW wind turbine. Osgood, R.M. (Solar Energy Research Institute, Wind Energy Research Center, Golden, CO (US)). vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Preliminary results from the 1988 wind season fatigue test of Northern Power systems' 100KW wind turbine are summarized in this report. The wind turbine is a two-bladed upwind teetering hub configuration with passive blade pitch control. Data presented for both teetering hub and locked-out teeter (rigid rotor) furnishes a comparison of cyclic loads developed for both hub configurations. Preliminary results are given. These results provide a preliminary view of steady operating loads and cyclic loads required for fatigue damage predictions and a comparison of rigid rotor and teetering rotor dynamic response to random inflow conditions.

2406 Initial structural response measurements for the Sandia 34-meter VAWT test bed. Ashwill, T.D. (Sandia National Labs., Wind Energy Research Div., Albuquerque, NM (US)). vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Sandia National Laboratories has designed and constructed a 34-meter diameter vertical axis wind turbine (VAWT) Test Bed. The machine will be used to advance research in aerodynamics and structural dynamics, improve fatigue life prediction capabilities, and investigate control algorithms and system concepts. The Test Bed has extensive instrumentation including 70 strain gauges to measure blade and tower response. Immediately after the blades were mounted, blade gravity stresses were measured and a modal analysis on the stationary rotor was performed to determine zero rpm modal frequencies. Assembly and start-up tests have been completed, and testing is in the machine characterization phase. Resonance surveys are underway to fully characterize the modal frequencies and mode shapes of the rotor, drive train and support cables. Measured gravity stresses, centrifugal stresses, and modal frequencies are compared to predicted values.

2407 Aerodynamic performance of the Sandia National Laboratories 34-meter-diameter vertical axis wind turbine test bed. Klimas, P.C. (Sandia National Labs., Albuquerque, NM (USA)); Stephenson, W.A. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

Sandia National Laboratories (SNL) is currently operating its Department of Energy (DOE) -funded 34-M-diameter Vertical Axis

Wind Turbine (VAWT) Test Bed on a Department of Agriculture (USDA) site near Amarillo, Texas. This versatile VAWT, rated at 500 kW in a 12.4 m/s (28 mph) wind, has been designed to demonstrate aerodynamic, structural dynamic, and control strategies intended to improve the effectiveness of VAWT systems.

2408 **Model validation of the Sandia 34-meter test bed turbine using substructured modal-testing.** Carne, T.G. (Sandia National Labs., Albuquerque, NM (USA)); Lauffer, J.P.; Gomez, A.J.; Ashwill, T.D. vp of Proceedings of the eighth ASME wind energy symposium. Berg, D.E. Klimas, P.C. American Society of Mechanical Engineers, New York, NY (1989). DOE Contract AC04-76DP00789. (CONF-890102–: 12. ASME annual energy-sources technology conference and exhibition, Houston, TX (USA), 22-25 Jan 1989).

The Sandia 34-Meter Test Bed Turbinre is a vertical-axis wind turbine, thirty-four meters in diameter, designed to provide a test-bed for research in aerodynamics, structures and control. In order to design a large wind turbine, knowledge of the modal frequencies and mode shapes is essential for predicting structural response. During the design, analytical or finite element models are utilized for estimates of these modal parameters. However, when hardware becomes available, modal testing can be used to verify or update the models. The concept of substructure modal testing was developed for the Sandia 34-Meter Test Bed in order to more fully evaluate the accuracy of the finite element model. Instead of performing only one test on the entire turbine, separate tests and analyses were performed on major substructures of the turbine, including three separate blade sections, the tower supported by the guy cables, and the entire turbine. The results are compared to analytical predictions from the finite element models of the substructures and the entire turbine.

20 ELECTRIC POWER ENGINEERING

Refer also to citation(s) 2607

2001 Power Plants and Power Generation

Refer also to citation(s) 2045, 2046, 2070, 2071, 2564, 2565, 2759

2409 (CONF-891113–6) **Comparison of advanced power generation technologies using computer simulations.** Rodgers, B.R.; Maude, C.M. Oak Ridge National Lab., TN (USA). [1989]. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. From American Institute of Chemical Engineers annual meeting; San Francisco, CA (USA); 5-10 Nov 1989. Order Number DE90002494. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The intent of this report was to evaluate 'advanced technologies' for power generation by comparing examples from each generic type on a common basis. Due to the diversified nature of these technologies, computer process simulations were found to be the only suitable means for obtaining a common basis. A large number of process options significantly effected the performance of the advanced technologies. Independent measurements were made to determine the efficacy of the most important ones, namely, plant size, hot gas cleaning, supercritical steam cycle, air blown versus oxygen blown gasifiers, high sulphur coal, integrated oxygen plant, and advanced high temperature gas turbines. The results are summarized. 3 refs., 2 figs., 3 tabs.

2410 (EPRI-CS–5588-Vol.3) **Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report.** Roberts, B.W.; Askins, M.C. Electric Power Research Inst., Palo Alto, CA (USA); Combustion Engineering, Inc., Chattanooga, TN (USA); Central Electricity Research Labs., Leatherhead (UK). c Nov 1989. 137p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

One of the objectives of EPRI contact 2253-1, "Estimating the Remanent Life of Boiler Pressure Parts", was the development of a metallographic approach relating microstructural degradation of parent material to remaining life. This Report describes the work undertaken in completion of this objective. A cast of 1Cr1/2Mo steel has been creep tested in argon at stresses in the range 34–80 MPa and temperatures between 590–630°C in various heat treatment states, including normalized and tempered, and overaged. Various metallurgical techniques have been used and parameters measured on the ex-creep tested specimens, for assessment of their use in remanent life evaluations. These include hardness, bulk extraction of carbides and x-ray examination of the phases present, determination of matrix solute content, x-ray determination of the matrix lattice parameter and carbide extraction replication of the structure and measurement of various interparticle spacing parameters. In application to plant the interparticle spacing can be determined from a small sample removed from the component. Either cast-to-cast bounds on the constants required by the model can be used or determinations of the cast specific constants made on the sample. Of the other metallurgical parameters examined it is concluded that the current technique of bulk extraction does not allow useful determination of matrix composition nor carbide phases present. 60 refs., 80 figs., 18 tabs.

2411 (EPRI-EL–6483) **Knowledge-based system: Voltage and VAR [volt-ampere-reactive] dispatch: Final report.** Tweed, E.D. Electric Power Research Inst., Palo Alto, CA (USA); Union Electric Co., St. Louis, MO (USA). c Oct 1989. 85p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The objective of this research project is to develop a demonstration volt/VAR dispatch knowledge-based system that develops strategies to achieve a predetermined voltage profile and to relieve overloaded devices. This knowledge-based system utilizes a realistic model of an electrical utility and its interconnections. It produces results that can be compared and evaluated with respect to the procedures that would be followed in a control center if a similar problem occurred. A realistic simulation was created to model an electric utility system in normal and abnormal states. The knowledge-based system examines the difference between the normal and abnormal states of the electrical network, identifies the problems that have occurred and develops a diagnosis of the probable cause. 4 refs., 1 fig., 25 tabs.

2412 (EPRI-GS–5949) **Guidelines for the prevention of economizer inlet header cracking in fossil boilers: Final report.** Stephenson, G.G. Electric Power Research Inst., Palo Alto, CA (USA); Ontario Hydro, Toronto, ON (Canada). c Nov 1989. 188p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A large number of utilities are experiencing cracking of the inlet headers of economizers in fossil boilers. The first evidence of its occurrence is generally a pinhole leak in the header/stub tube attachment weld. Inspection of the tube bore hole in the header will reveal numerous longitudinally oriented cracks which may propagate across the ID ligament spacing between bore holes. The mechanism is associated with the introduction of relatively cold feedwater to the hot header during start-up and off-line drum top-up periods producing thermal fatigue damage. State-of-the-art techniques for the prevention and control of economizer inlet headers have been identified from utilities' and boiler manufacturers' experience. This data has been used to produce a comprehensive and practical guideline for utility use. The guideline has been set-up to lead the user through a step-by-step process, indicating what information needs to be obtained at each step, how it should be analyzed, and the conclusions to draw. Inspection techniques to determine the extent of the damage and temperature monitoring tests to correlate the damage with operating parameters are important first steps in the analysis. Operating procedure modifications to reduce thermal stresses are discussed which will alleviate the problem. 20 refs., 53 figs.

2413 (EPRI-GS–6253) **The TVA moving-manifold targeted-chlorination system: Second field demonstration: Final report.** Moss, R.D.; Gautney, S.P.; Johnson, J.T.; Bain, J.W. Jr.; Scrudder, R.O.; Vigon, B.W.; Reichenbach, N.G. Electric Power Research Inst., Palo Alto, CA (USA); Battelle Columbus Div., OH (USA). c Nov 1989. 147p. Sponsored by Electric Power Research Institute.

Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Tennessee Valley Authority has pioneered the use of a novel technique, called "Targeted Chlorination," to control biological fouling in utility condensers. In 1983 and 1984, TVA made the first field evaluation of a targeted chlorination system at the Kingston Fossil Plant. This report describes the design, operations, and results of a second field demonstration conducted during 1985 at the John Sevier Fossil Plant. System design, operation, and data collection were performed by TVA; data analysis and interpretation were provided by Battelle-Columbus Division. Specific evaluations address the effect of targeted chlorination on the unit's thermal performance, the unit heat rate, the unit's chlorine usage, the system's operational dependability, and the impact on plant manpower requirements. An evaluation comparing the costs of a targeted chlorination system to a dechlorination system is also included. 24 refs., 49 figs., 30 tabs.

2414 (EPRI-GS–6544) **Gas turbine blade life assessment and repair guide: Final report.** Swaminathan, V.P.; Lowden, P. Electric Power Research Inst., Palo Alto, CA (USA); Southwest Research Inst., San Antonio, TX (USA); Liburdi Engineering Ltd., Hamilton, ON (Canada). Nov 1989. 188p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Combustion turbine hot section rotating blades are fabricated from nickel-base superalloys and operate at high temperatures. Both metallurgical and mechanical property degradation of the blading material occurs during service which can limit the useful service life of blades. It is important to assess the condition of blades periodically and remaining life estimated to provide guidelines for replacement or reconditioning of the blades. Sections 1 through 7 of this report present the necessary background for the user of this guidebook to understand the various aspects of the superalloys. Sections 8 and 9 provide step-by-step guidelines for remaining life assessment, repair and refurbishment of blades. Initially, this report provides a background on the metallurgy of the superalloys and how service aging changes the microstructural features and adversely affect the mechanical properties. A thorough review of methodologies available in the literature to estimate the life of blades under foreign object damage, creep and thermal-mechanical fatigue conditions is presented in the next section. How engine operating conditions affect blade life and the various destructive and non- destructive testing methods to evaluate the condition of blades are discussed next. Various repair and refurbishment procedures available to restore service damaged blades are then presented. Finally, general guidelines are presented for blade life assessment and for repair and refurbishment of service-run blades. 94 refs., 87 figs., 6 tabs.

2415 (EPRI-GS–6574) **Model validation: Cooling-tower performance: Final report.** Miller, P.B.; Starnes, G.L. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Gas and Electric Co., San Ramon, CA (USA). Technical and Ecological Services. c Nov 1989. 45p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The purpose of the fill performance validation project is to examine the accuracy of the cooling tower computer models and fill performance data that have recently been made available through EPRI. This project compares actual full scale tower performance test results to those predicted by the tower models. The cooling tower models used in this project include: FACTS/FACTR, developed by the Tennessee Valley Authority (TVA); VERA2D-86/VERAT, developed by CHAM of North America; and TEFERI, developed by Electricite de France. All full scale cooling tower performance test data used to validate the models were collected at PG&E's Full Scale Crossflow Testing Facility. Three different fills have been tested in this facility during this project. Test results for one of the fill types (Type 'T') are directly compared to predictions based on results from the EPRI Small Scale Test Facility. The other full scale test results are used to validate the hybrid fill modeling capabilities of the FACTS computer code. 9 refs., 6 figs., 7 tabs.

2416 (N–89-27702) **Development and refinement of test bed simulations.** Dravid, N.V.; Miller, D.R.; Patterson, A.G.; Gombos, F.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Aug 1989. 8p. (NASA-TM–102335;E–5043;NAS–1.15:102335;CONF-8908177–: 24. intersociety energy conversion engineering conference, Washington, DC (USA), 6-11 Aug 1989). Available from NTIS, PC A02/MF A01.

Lewis Research Center of NASA, with support from Rocketdyne, was engaged in non-real time computer simulation effort for the Space Station Freedom Electric Power System (EPS) EASY5, a simulation package, is used as the primary tool for this activity. Early in the design of the EPS, two test beds were set up at Lewis. The Integrated Test Bed (ITB), that combines and upgrades these test beds, is in the planning stage. The test beds are designed to functionally represent many of the components of the EPS and their interconnections. The simulation effort is primarily directed towards these test beds. Model verification is performed using test bed data.

2417 (PB–89-229421/XAB) **Advanced gas-turbine steam-injection program water treatment for steam-injected gas-turbine systems. Topical report, October 1987-March 1989.** Ayala, R.E.; Thames, J.M. General Electric Co., Cincinnati, OH (USA). Aircraft Engines. Mar 1989. 314p. Available from NTIS, PC A14/MF A01.

Portions of this document are not fully legible.

Water availability, treatment costs, and resultant water quality to ensure technical reliability and economic feasibility of a power plant were determined to define options for reliable, yet cost-effective, water-treatment processes for advanced cogeneration cycles. A review of corrosion and deposition principles for both combustion and steam systems was conducted to identify the most detrimental contaminants causing corrosion and deposition in gas-turbine systems. Specifications for the maximum levels of these contaminants were established for turbine combustion gases and steam boiler (i.e., blowdown) water, and treatment process product water. A Base Case water treatment process recommended for the water treatment system by the water treatment companies contacted includes multimedia and carbon filtration, reverse osmosis, and demineralization.

2418 (PB–89-231609/XAB) **Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988.** Hollander, S.; Makovich, L. DRI/McGraw-Hill Energy Service, Lexington, MA (USA). Dec 1988. 195p. Available from NTIS, PC A09/MF A01.

This study first examined the total maximum potential for gas use in coal-fired electric power plants. In the next phase of the study, the economics of using natural gas reburn with sorbent injection was compared with flue-gas desulfurization systems and switching to low-sulfur coal in each coal-fired plant to determine which might be the lowest cost option for reducing SO_2 emissions. The study finds that the potential US natural gas demand from the environmental control market in competition with other SO_2 control technologies ranges from 200 to 750 billion cubic feet, depending on the cost of natural gas to the plant and the amount (in dollars per tonnage emission reduction) the plant is willing to pay for emissions control. The study is an attempt to analyze the potential amount of gas that may be used to meet emissions control requirements placed on coal-fired electric generating units.

2419 (POEF-M–19) **Power circuit breaker test system.** Deck, J.W.; Kidder, J.S. Martin Marietta Energy Systems, Inc., Piketon, OH (USA). Mar 1988. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00001. (CONF-880379–2: DOE maintenance management conference, New Orleans, LA (USA), 28 Mar - 1 apr 1988). Order Number DE90002230. Available from NTIS, PC A03/MF A01 - OSTI.

The intended use of this instrument is to make timing and velocity measurements on switchyard power circuit breakers. Previous systems used for this task utilized a controller to actuate the breaker, condition the pole closure and position transducer inputs, and operate a high speed speed visicorder oscillograph that recorded the input responses: the timing and velocity measurements were done manually using the visicorder output. The system developed at Martin Marietta is designed around a ruggedized IBM PC/XT compatible computer and a monochrome CRT display. The computer acts on the operator commands to actuate the breaker and then acquires the pole closure and transducer data during the operation. The computer then serves as the display controller to present the graphical results on the CRT. The operator can now make automated

timing and velocity measurements from the on screen display. A dot matrix printer is provided for a hard copy record of the CRT display. 5 figs., 1 tab.

2002 Environmental Control Technology

Refer also to citation(s) 2068, 2074, 2409, 2415

2420 (CONF-8903173–1) **Fluid/particle separation and coal cleaning: Progress, potential advances, and their effects on FGD [flue-gas desulfurization].** Livengood, C.D.; Doctor, R.D. Argonne National Lab., IL (USA). [1989]. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Annual conference on filtration and separation; Pittsburgh, PA (USA); 27-29 Mar 1989. Order Number DE90002249. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Argonne National Laboratory (ANL) has been investigating several approaches to SO_2 and NO_x control that could play significant roles in future emission-control strategies. These techniques include greater application of an existing technology, physical coal cleaning (PCC), as a precombustion complement to FGD, and the combined removal of NO_x and SO_2 in flue-gas cleanup (FGC) systems based on spray drying (a wet/dry process) or in-duct injection of dry sorbents. This paper discusses the results of some of that research with particular attention to the beneficial role of fabric filtration in the dry and wet/dry FGC processes. 7 refs., 5 figs.

2421 (CONF-8904289–1) **Combined NO_x/SO_2 control technology.** Harkness, J.B.L.; Livengood, C.D. Argonne National Lab., IL (USA). 1989. 25p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Solutions '89 international conference; Pine Mountain, GA (USA); 30 Apr - 3 may 1989. Order Number DE90002272. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Commercially available control technology for NO_x and SO_2 typically involves separate systems for each pollutant, thereby greatly increasing system complexity. Research and development programs are currently working on a number of integrated technologies that offer the promise of removing both pollutants from boiler flue gases in a single system. This paper will review the commercially available processes and will then describe those integrated systems under development in terms of operational principles, the hardware required, byproducts, costs (if available), and developmental status. 26 refs., 15 figs.

2422 (DOE/PC/79796–T7) **Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 7, December 1, 1988–February 28, 1989.** Energy and Environmental Research Corp., Irvine, CA (USA). 23 Mar 1989. 68p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-87PC79796. Order Number DE90002869. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The objective of this project is to evaluate and demonstrate a cost effective emission control technology for acid rain precursors, oxides of nitrogen (NO_x) and sulfur (SO_x), on three coal fired utility boilers in Illinois. The units selected are representative of pre-NSPS design practices: tangential, wall, and cyclone fired. The specific objectives are to demonstrate reductions of 60 percent in NO_x and 50 percent in SO_x emissions, by a combination of two developed technologies, gas reburning (GR) and sorbent injection (SI). With GR, about 80–85 percent of the coal is fired in the primary combustion zone. The balance of the fuel is added downstream as natural gas to create a slightly fuel rich environment in which NO_x is converted to N_2. The combustion process is completed by overfire air addition. SO_x emissions are reduced by injecting dry sorbents (usually calcium based) into the upper furnace, at the superheater exit or into the ducting following the air heater. The sorbents trap SO_x as solid sulfates and sulfites. 8 figs., 15 tabs.

2423 (DOE/PC/88868–T3) **Characterization and modification of particulate properties to enhance filtration performance: Quarterly technical progress report, December 1988–February 1989.** Snyder, T.R.; Vann Bush, P. Southern Research Inst., Birmingham, AL (USA). 20 Mar 1989. 39p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88868. (SRI-ENV–89-208-6666). Order Number DE90001947. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An abstract search and review of pertinent articles were completed as part of activity 3.1. A summary of the review is included in this report. Testing procedures have been established for the turbulent mixing and combination of two types of fly ash in the mixing and conditioning chamber that was designed and fabricated under activity 3.2. Additional analyses of unconditioned ashes have occurred this quarter under activity 3.3. Relatively cohesive ash from Gulf Power's Plant Scholz in Sneads, Florida, was obtained during this quarter under Task 2, and has been analyzed in the laboratory. Some additional tests of the noncohesive Monticello ash were also performed. Several potential conditioning agents have been identified and include fine powders such as talc, silica, calcium hydrogen phosphate, colloidal aluminum oxide, and selected fly ashes. Several grades of finely ground silica powders have been obtained for conditioning studies. The evaluation of conditioning agents has proceeded this quarter with the analyses of ammonium sulfate products, unconditioned ashes resuspended and collected in the mixing and conditioning chambers, ashes conditioned with ammonium sulfate, and two dissimilar ashes mixed at various ratios. 7 figs., 3 tabs.

2424 (DOE/PC/88874–T6) **Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 5, July 1–September 30, 1989.** Acurex Corp., Research Triangle Park, NC (USA). Environmental Systems Div. 26 Oct 1989. 43p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88874. Order Number DE90002757. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During this reporting period, July 1, 1989 through September 30, 1989, bench-scale experiments have been conducted to measure the mass transfer and kinetic rates at simulated duct injection conditions. Section 2 summarizes the tank reactor test results. The stirred tank reactor (Task 2.1) was found to be able to simulate a droplet having a diameter of 180 μm if a 1 s contact time were specified. Experiments were run with different lime types. Tests with 0.1 M Mississippi hydrate and 0.1 M Mississippi slaked lime were run for comparison with 0.1 M reagent $Ca(OH)_2$ slurry. No significant differences in reactivity were measured among these 3 limes. Additional tests with Mississippi hydrate were run to evaluate the effect of slurry solids content on SO_2 removal. Clear solution saturated with $Ca(OH)_2$ was tested as the baseline followed by tests with 0.1 M and 0.4 M $Ca(OH)_2$ slurry. Section 3 reports the status of differential reactor (Task 2.2) tests. The differential reactor apparatus and methods are being modified to determine the effect of initial water content on the sorbent reactivity. Section 4 describes the status of short-time differential reactor (STDR) tests for Task 2.3. Several sorbents were produced using Mississippi CaO with surface area ranging from 29–75 m^2/g and porosity ranging from 29–49 percent. 24 figs., 4 tabs.

2425 (EPRI-EN–6518-Vol.2) **EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 2: Technical reference manual.** Electric Power Research Inst., Palo Alto, CA (USA); Enertech Consultants, Campbell, CA (USA). c Oct 1989. 140p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The EPRI Electric and Magnetic Field Digital EXposure (EMDEX) system consists of hardware and software for characterizing electric and magnetic field exposures. The EMDEX meter is a computer-based portable unit that samples, at a user-programmable rate, the three vector components of magnetic flux density, a measure of the average electric field acting on the torso of the wearer (if an optional sensor is worn) and a measure of rotational motion of the meter in the earth's magnetic field. Modules of the DATACALC software package are used to program the EMDEX, retrieve data at the end of a measurement session, analyze EMDEX data, and prepare tabular and graphical data summaries. The User Manual is designed to provide instruction on the use of the exposure system hardware and software. The Technical Reference Manual provides additional, detailed descriptions of the hardware, software and methodologies used in the EMDEX system.

2426 (ETDE-mf–0717865) **Flue gas denitrification processes using tissue filters. Final report.** Technische

Universitaet Muenchen, Lehrstuhl fuer Thermische Kraftanlagen mit Heizkraftwerk. Bericht. Geppert, D. Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl fuer Thermische Kraftanlagen mit Heizkraftwerk; Deutsche Forschungsgemeinschaft, Bonn (Germany, F.R.). Jul 1988. 101p. (In German). DFG Th 249/7-1. Order Number DE90717865. Available from NTIS (US Sales Only), PC A06/MF A01.

For clarifying the role of fly ashes as catalysts for the reduction of nitric oxides with ammonia, there was an investigation of fly ashes from power stations fired with lignite or hard coal as well as from refuse incineration plants. First, the measurement of the NO_x separation efficiency took place in a fixed bed reactor and then in a laboratory scale fluidized bed reactor at temperatures of 100-450$_0$C. The degree of nitrogen removal in the fixed bed was very low. Some of the tested fly ashes did not show any reaction in the fluidized bed. Others showed considerable degrees of NO_x separation only at temperatures of 300-400^{0}C. The separation efficiency of these fly ashes rose up to the limit of the temperature range used for testing. In some special cases, a separation efficiency of 40% or more than 90% at temperatures of 450^{0}C was measured. The other fly ashes reached a separation efficiency of 10-30%. The NO_x separation observed is mainly due to a reduction of the NO by the unburnt elements of the fly ashes. A catalytic effect with regard to the reaction between NO and NH_3 could not be proved. The ammonia concentration has, an influence on the dentrification degree in the upper temperature range only in a few fly ashes. (orig./EF).

2427 (ETDE-mf–0717889) **The DESONOX flue gas purification process.** Ohlms, N. Stadtwerke Muenster G.m.b.H. (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). [1989]. 16p. (In German). BMFT 0326564A. Order Number DE90717889. Available from NTIS (US Sales Only), PC A03/MF A01.

The DESONOX method is a combined method for the of removal of sulphur and nitrogen from flue gases from power stations, which provides as final product a sulphuric acid that can be used in industry. It was fully developed by Degussa (Frankfurt) in cooperation with Lentjes (Duesseldorf) and Lurgi (Frankfurt) as well as the Stadtwerke Muenster. The first large-scale DESONOX pilot plant for the purification of the waste gases from block 3 of the combined heat and power station of the Stadtwerke Muenster was realized in a construction time of only 14 months. This pilot plant, which is promoted by the Federal Minister for Research and Technology (BMFT), is presently being put into operation. The article reports on first operational experiences. (orig.).

2428 (NEI-DK–218) **Measurements of gas concentrations and temperature in a boiler room.** Energiministeriets Varmepumpeforskningsprogram. Rapport, 68. Boll Illerup, J.; Dam-Johansen, K. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Kemiteknik. Jul 1989. 31p. (In Danish). Order Number DE90719047. Available from NTIS (US Sales Only), PC A03/MF A01.

Energiministeriets Varmepumpeforskningsprogram. Rapport, 68.; EFP-86.

The most significant sources of air pollution by nitrogen oxides are coal-fired power stations and cars. In Denmark, a law has been past which forces power staions to reduce NOx emission by legally determining a quota of allowed content of nitrogen oxides in flue gasses. Emission of this chemical can be reduced with the help of combustion control techniques. This method is much cheaper than desulphurization of flue gasses and is therefore currently of considerable interest. The method is based upon the reduction of oxygen concentration in, and the temperature of, the flame. In connection with design and optimization of these techniques interest currently centres on methods for measuring the local temperature and gas concentrations in the boiler's combustion chamber. The project concentrates on temperature and gas concentration measurements (CO, NOx, SO2 and CO2) in relation to excess of air and boiler load and emphasis is laid on the evaluation of the actual measuring methods. (AB) 10 refs.

2429 (ORNL/FTR–3473) **[US Agency for International Development–Government of India collaborative coal projects]: Foreign trip report, October 21, 1989–November 2, 1989.** Krishnan, R.P. Oak Ridge National Lab., TN (USA). 17 Nov 1989. 28p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE90003286. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Under the Phase II, Alternative Energy Resources Development (AERD) project, of the United States Agency for International Development (USAID) and the Government of India (GOI), five collaborative coal projects have been initiated in the areas of: (1) NO_x/SO_2 control from coal-fired power plants, (2) slagging combustor development for high-ash Indian coals, (3) characterization of Indian coals for combustion and gasification, (4) diagnostic studies for prediction of power plant life expectancy, and (5) environmental and natural resource analysis of coal cycle. The Pittsburgh Energy Technology Center (PETC) has the implementation responsibility for these projects. The Oak Ridge National Laboratory (ORNL) is providing cross-cut technical coordination and support for these five projects.

2430 (PB–89-218218/XAB) **Development of the advanced utility simulation model. Report for May 1985-September 1988.** Capone, R.L.; Jones, L.G. Science Applications International Corp., McLean, VA (USA). 1989. 17p. Available from NTIS, PC A03/MF A01.

This paper discusses the development of the Advanced Utility Simulation Model (AUSM), developed for the National Acid Precipitation Assessment Program, to forecast air emissions of pollutants from electric utilities. AUSM integrates generating unit engineering detail with dynamic strategic decisions made by utility planners and coal miners. Decisions about capacity additions and emissions control strategies for one unit, state, and year influence (and are influenced by) decisions made for other units, states, and years. Emissions control economics are controlled by unit-specific factors and by market factors. Designed as a cost-minimization model, AUSM integrates decisions about each unit with decisions about other units through competition for coal, interstate electricity transmission, intrastate system dispatch, and power pool, state, and unit-level emissions limits.

2431 **Environmental issues associated with coal-fired power plants in India.** Ravindram, M. *Transactions of the American Nuclear Society (USA),* 57: 82-83 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Per capita energy consumption has come to be regarded as an index of a country's economic development. Impressive strides have been made in the capacity to generate electricity. Increasing industrialization and rapid urbanization appear to be the two primary factors responsible for this tremendous spurt in energy demand. Electricity is the most preferred form of energy because of its versatility, convenience, and cleanliness. A major share of electricity generation comes from the use of fossil fuels, particularly coal. While electricity is clean energy at the point of consumption, its generation through coal-fired thermal power plants is beset by severe environmental concerns. In facts, coal-based thermal power plants constitute a formidable source of solid, liquid, and gaseous emissions into the environment. Many of these environmental problems are inherent in the technology itself with no easy solutions. Consequently, proper siting, choice of appropriate control technology, and an in depth analysis of environmental impact are essential to ensure a healthy development and to minimize concomitant environmental deterioration.

2003 Power Transmission and Distribution

Refer also to citation(s) 2411, 3130

2432 (ANL–88-37) **Practical superconductor development for electrical power applications: Annual report for FY 1988.** Poeppel, R.B. Argonne National Lab., IL (USA). Feb 1989. 54p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. Order Number DE90001804. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Development of useful high-temperature superconductors (HTSCs) requires synthesis of the various superconducting oxide compounds; fabrication of wires, tapes, and thin films from these

compounds; capability of forming composite structures that incorporate integral insulators or stabilizers; and design of efficient components and systems. This report documents research efforts aimed at producing superconducting components based on the oxide systems Y–Ba–Cu–O, Bi–Sr–Ca–Cu–O, and Tl–Ca–Ba–Cu–O. Topics discussed are synthesis of compounds from each system; fabrication of monolithic tapes, wires, and castings; effects of silver additions on mechanical and electrical properties; fabrication of composite tapes that incorporate silver or ceramic substrates; use of pressure or electrochemical bonding to connect the superconductors to high-conductivity metals; fabrication of thin films for electronic devices; optimization of heat treatment schedules; the microstructural, mechanical, and electrical properties of the forms produced; and studies on the thermomagnetic stabilities of HTSCs and the implications for system design. Collaborations in this research between Argonne National Laboratory, universities, industrial partners, and other national laboratories are identified and results from the collaborations are presented. The report closes with an assessment of the status of the research efforts as of September 1988. 53 refs., 37 figs., 1 tab.

2433 (PB–89-872360/XAB) **Lightning, surge, and transient protection. December 1982-September 1989 (Citations from the NTIS data base). Report for December 1982-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 142p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867775.

This bibliography contains citations concerning techniques and devices for the protection of electronic and electrical equipment from lightning and electrical surges, and data and protective devices for lightning strikes on structures, ships, and aircraft. The citations include research on suppressors, limiters, lightning arresters, electromagnetic pulse protection devices, and overvoltage protectection networks. Excluded are references to electromagnetic shielding, which are found in a separate published search. (This updated bibliography contains 260 citations, 20 of which are new entries to the previous edition.)

21 NUCLEAR POWER PLANTS

2434 (IAEA-TECDOC–507) **Power reactor information system (PRIS). Reference and on-line access manual.** International Atomic Energy Agency, Vienna (Austria). Jun 1989. 83p. Order Number DE90608683. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Since the very beginning of commercial operation of nuclear power plants, the nuclear power industry worldwide has accumulated more than 5000 reactor years of experience. The IAEA has been collecting Operating Experience data for Nuclear Power Plants since 1970 which were computerized in 1980. The Agency has undertaken to make Power Reactor Information System (PRIS) available on-line to its Member States. The aim of this publication is to provide the users of PRIS from their terminals with description of data base and communication systems and to show the methods of accessing the data.

2435 (INIS-mf–12011) **Development of methods for the evaluation and reduction of risk factors for the maintenance of nuclear power plants.** Preuss, W.; Ogurek, K.H. Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (Germany, F.R.). Inst. fuer Unfallforschung und Ergonomie (IfU); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1988. 203p. (In German). Contract BMFT 1500 735/3. Order Number DE90722065. Available from NTIS (US Sales Only), PC A10/MF A01.

The maintenance of a nuclear power plant is an essential requirement for its safe operation. Recent experience has however revealed increasingly more deviations and disturbances associated with maintenance work - in particular related to human error. The investigations should contribute to the further improvement of the conditions for safe and optimal maintenance procedures and thus minimize the risk of disturbances arising from them. The first step of the investigation is presented here, in which the methodological preliminary work was carried out and a suitable procedure developed. A basis was provided by means of extensive literature research and analysis. Additional information was obtained through discussions with experts (research workers as well as plant operational management). In particular suitable techniques of investigation and analysis are presented in detail, the problem structure of the field of investigation bas been worked out, and a methodology for the evaluation of data has been developed. Furthermore criteria have been formulated with which nuclear power plants and maintenance processes can be choosen for an economic way of investigation, and a procedure is presented which serves the investigator to check and to improve the methodology. Finally, proposals for further investigations are given. (orig.).

2436 (YJT–89-08) **Recent decommissioning experiments - a literature survey. Quarterly report 3. quarter 1987.** Salonen, Pentti. Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). Jun 1989. 55p. (In Finnish). Order Number DE90608689. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The decommissioning plans of the Finnish nuclear power plants shall be dated every five years. Therefore it is important to follow the international scientific and technological progress in the field and to utilize the practical experiences. This study is a general survey of the decommissioning projects of foreign nuclear power plants. The best documented and reported decommissioning projects, Shippingport (USA), JPDR (Japan), KKN (FRG) and WAGR (UK) are dealt with greater detail. The types and operations histories of the nuclear facilities are described and the considerations affecting decommissioning choices (immediate or deferred dismantlement) are also related. These considerations are not generally applicable, but they are always determined in accordance with the national policy and regulations as well as the design of the nuclear facility. The activity estimates are facility specific and depending on the reactor type and operating history and not directly on rated power. The radiation doses to the workers depend mainly on dismantling techniques and radiological protection measures used in decommissioning. Generally the doses remain below estimates.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

Refer also to citation(s) 2445, 2447, 2450, 2451, 2452, 2496, 2504, 2513, 2516, 2517, 2521, 2528, 2536, 2540, 2542, 2544, 2552, 2553, 2825

2437 (CONF-8910222–5) **Human factors survey of advanced instrumentation and controls.** Carter, R.J. Oak Ridge National Lab., TN (USA). 1989. 22p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 17. water reactor safety information meeting; Rockville, MD (USA); 23-25 Oct 1989. Order Number DE90002477. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A survey oriented towards identifying the human factors issues in regard to the use of advanced instrumentation and controls (I&C) in the nuclear industry was conducted. A number of United States (US) and Canadian nuclear vendors and utilities were participants in the survey. Human factors items, subsumed under the categories of computer-generated displays (CGD), controls, organizational support, training, and related topics, were discussed. The survey found the industry to be concerned about the human factors issues related to the implementation of advanced I&C. Fifteen potential human factors problems were identified. They include: the need for an advanced I&C guideline equivalent to NUREG-0700; a role change in the control room from operator to supervisor; information overload; adequacy of existing training technology for advanced I&C; and operator acceptance and trust. 11 refs., 1 tab.

2438 (EGG-M–89186) **In-core thermal hydraulic and fission product calculations for severe fuel damage analyses.** Suh, K.Y.; Sharon, A.; Hammersley, R.J. EG and G Idaho, Inc., Idaho Falls, ID (USA); Fauske and Associates, Inc., Burr Ridge, IL (USA). May 1989. 33p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891103–38: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90002068. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Best-estimate calculations of realistic source terms are presented which reduce uncertainties in predicting fission product release from the UO_2 fuel over the temperature range between 770 K and 3000 K. The proposed method of correlation includes such fuel morphology effects as equiaxed fuel grain growth and fuel-cladding interaction. The method correlates the product of fuel release rate and equiaxed grain size with the inverse fuel temperature to yield a bulk mass transfer correlation. It was found that less and slower releases are predicted utilizing the bulk mass transfer correlation than such conventional literature correlations as the steam oxidation model and the NUREG-0956 correlation. A Severe Fuel Damage (SFD) analysis code was developed to perform the thermal hydraulic and fission product calculations needed to analyze the Power Burst Facility SFD tests. The predictions utilizing the bulk mass transfer correlations overall followed the experimental time-release histories during the course of the heatup, power hold and cooldown phases of the transients. Good agreements were achieved for the integral releases both in timing and in magnitude. The proposed bulk mass transfer correlations can be applied to both current and advanced light water reactor fuels. 17 refs., 8 figs., 3 tabs.

2439 (JAERI-M–89-070) **BWR plant dynamic analysis code BWRDYN user's manual.** Yokobayashi, Masao; Yoshida, Kazuo; Fujiki, Kazuo. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 99p. (In Japanese). Order Number DE90719541. Available from NTIS (US Sales Only), PC A05/MF A01.

Computer code BWRDYN has been developed for thermal-hydraulic analysis of a BWR plant. It can analyze the various types of transient caused by not only small but also large disturbances such as operating mode changes and/or system malfunctions. The verification of main analytical models of the BWRDYN code has been performed with measured data of actual BWR plant. Furthermore, the installation of BOP (Balance of Plant) model has made it possible to analyze the effect of BOP on reactor system. This report describes on analytical models and instructions for user of the BWRDYN code. (author).

2440 (PNL–6732) **Design and operation of gamma scan and fission gas sampling systems for characterization of irradiated commercial nuclear fuel.** Knox, C.A.; Thornhill, R.E.; Mellinger, G.B. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 31p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. Order Number DE90001862. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

One of the primary objectives of the Materials Characterization Center (MCC) is to acquire and characterize spent fuels used in waste form testing related to nuclear waste disposal. The initial steps in the characterization of a fuel rod consist of gamma scanning the rod and sampling the gas contained in the fuel rod (referred to as fission gas sampling). The gamma scan and fission gas sampling systems used by the MCC are adaptable to a wide range of fuel types and have been successfully used to characterize both boiling water reactor (BWR) and pressurized water reactor (PWR) fuel rods. This report describes the design and operation of systems used to gamma scan and fission gas sample full-length PWR and BWR fuel rods. 1 ref., 10 figs., 1 tab.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

Refer also to citation(s) 2437, 2438, 2440, 2470, 2475, 2486, 2495, 2496, 2504, 2511, 2513, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2528, 2530, 2531, 2533, 2535, 2540, 2541, 2547, 2548, 2549, 2550, 2551, 2553, 2555, 2558, 2559, 2805, 2816, 2825, 3594, 3991

2441 (CNEN-DR–88/80/A) **Determination of the protection set-points lines for the Angra-1 reactor core.** Furieri, E.B. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores. Mar 1980. 193p. (In Portuguese). (GNT–02/80). Order Number DE90608697. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

In this work several thermo-hidraulic calculation were performed to obtain Protection set-points lines for the Angra-1 reactor core in order to compare with the values presented by the vendor in the FSAR. These lines are the locus of points where $DNBR_{min}$= 1,3 and power = 1,18 x $P_{nominal}$ as a function of ΔT_m and T_m, the temperature difference and the average coolant temperature between hot and cold legs. A computation scheme was developed using COBRA-IIIF as a subroutine of a new main program and adding new subroutines in order to obtain the desired DNBR. The solution is obtained through a convergentce procedure using parameters estimated in a sensivity study. (author).

2442 (CONF-8910274–2) **Irradiation embrittlement of the shippingport neutron shield tank.** Chopra, O.K.; Shack, W.J. Argonne National Lab., IL (USA). Aug 1989. 23p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. From 15. MPA seminar on safety and reliability of plant technology; Stuttgart (Germany, F.R.); 5-6 Oct 1989. Order Number DE90001942. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The irradiation embrittlement of the Shippingport neutron shield tank material has been characterized. The results indicate embrittlement of the A212 grade B steel from low-temperature, low-flux environment. However, the shifts in Charpy transition temperature are lower than those for the HFIR surveillance samples. The data agree well with results from high flux test reactors. Annealing studies indicate complete recovery of embrittlement after a 2-h anneal at 400°C. 10 refs., 12 figs., 1 tab.

2443 (EPRI-NP–5708-Vol.1-Rev.1) **Determination of thermodynamic data for modeling corrosion: Volume 1, Sulfates (Revision 1): Final report.** Izatt, R.M.; Christensen, J.J.; Oscarson, J.L.; Gillespie, S.E. Electric Power Research Inst., Palo Alto, CA (USA); Brigham Young Univ., Provo, UT (USA). c Nov 1989. 125p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The aqueous reactions, $H^+ + SO_4^{2-} = HSO_4^-$, $Na^+ + SO_4^{2-} = NaSO_4^-$, and $H^+ + HSO_4^- = H_2SO_4(aq)$, were studied as a function of ionic strength (I) at 150, 175, 200, 250, 300, and 320°C using a flow calorimetric procedure. Log K, ΔH, ΔS, and ΔC_p values at I = O were derived from the data at each temperature. Using these experimental values, equations describing log K, ΔH, ΔS, and ΔC_p at I = O and temperatures from 150 to 320°C were derived for each system. The use of equations containing identical numbers of positive and negative charges on both sides of the equal sign (isocoulombic reaction principle) was evaluated as a technique for the extrapolation of log K values valid below 100°C to temperatures above 150°C. This evaluation indicated that the principle gives good estimates up to 320°C. 9 refs., 15 figs., 8 tabs.

2444 (EPRI-NP–5708-Vol.2) **Determination of thermodynamic data for modeling corrosion: Final report, Volume 2: Chlorides and acetates.** Izatt, R.M.; Christensen, J.J.; Oscarson, J.L.; Gillespie, S.E. Electric Power Research Inst., Palo Alto, CA (USA); Brigham Young Univ., Provo, UT (USA). c Nov 1989. 163p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The aqueous reactions, $H^+ + Cl^- = HCl$, $H^+ + Ac^- = HAc$, and $Na^+ + Ac^- = NaAc$ ($Ac = C_2H_3O_2^-$), were studied as a function of ionic strength at 275, 300, and 320°C using a flow calorimetric procedure. Log K, ΔH, and ΔS were determined from the fits of the calculated and experimental heats while ΔC_p values were calculated from the variation of ΔH values with temperature. The log K and ΔH values for the first two reactions agree well with literature values at these temperatures. No previous results have been reported for the third reaction. The use of equations containing identical numbers of positive and identical numbers of negative charges on both sides of the equal sign (isocoulombic reaction principle) was applied to the log K values determined in this study. The resulting plots of log K for the isocoulombic reactions vs 1/T were approximately linear, which demonstrates that the ΔC_p values for these reactions are approximately zero. 65 refs., 20 figs., 8 tabs.

2445 (EPRI-NP–6528) **Deposition of cobalt on surface-treated stainless steel under PWR conditions.** Lister, D.H.; Anderson, P.G.; Barry, B.J.; Lavoie, R.G. Electric Power Research Inst., Palo Alto, CA (USA); Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. c Oct 1989. 60p.

Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

As part of an on-going program aimed at reducing radiation exposures in light water reactors, the modification of surfaces to minimize their propensity to pick up radioactivity under reactor conditions has been studied. This report describes how stainless steel specimens, surface-treated with a variety of processes, picked up Co-60 from high-temperature water under PWR conditions in a high-pressure loop. The build-up of activity was monitored on-line with a movable gamma spectrometer. Off-line counting at the end of the experiment established the absolute activity levels, and selective examinations with SEM and metallography characterized the surface condition of the exceptional specimens. The effectiveness of the surface treatments was gauged by fitting simple parabolae to the activity build-up data and comparing the coefficients with those obtained from untreated control specimens. 10 refs., 23 figs., 4 tabs.

2446 (INIS-BR–1713) **Considerations about the uncertainty propagation in the probabilistic safety analysis.** Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1982. 39p. (In Portuguese). Order Number DE90608701. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Considerations about uncertainties propagation in the probabilistic safety analysis of nuclear power plants.

2447 (INIS-BR–1714) **Event tree for the Angra 1 big LOCA.** Oliveira, L.F.S. de. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1982. 42p. (In Portuguese). Order Number DE90608702. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The detailed discussion of event tree for the big LOCA in Angra 1 is presented. The emphasis is given to the qualitative analysis of the tree.

2448 (INIS-BR–1715) **Reliability study of low pressure recirculation system of Angra 1.** Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1989. 57p. (In Portuguese). Order Number DE90608703. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The reliability analysis of Low Pressure Recirculation System (LPRC) for Angra-1 reactor is presented.

2449 (Juel-Spez–488) **Program of research and development on the thorium utilization in PWRS. Final report (1979-1988).** Bilateral seminars of the International Bureau, Kernforschungsanlage Juelich GmbH. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Internationales Buero. 1988. 235p. Order Number DE90722226. Available from NTIS (US Sales Only), PC A11/MF A01.

Detailed investigations performed for a standard 1,300 MW_e PWR show that $(Th,U)O_2$ and $(Th,Pu)O_2$ fuels can be inserted in 3 and 4 cycle operating schemes without modifications in the fuel assembly or core design. The most important aspects of the fuel cycle have been covered. Ex-gel pelletizing of $(Th,U)O_2$ fuel making use of available LWR and HTR fuel manufacturing technology was demonstrated. The most promising application for Th-based fuels at present was proved to be the use of recycle plutonium in extended burnup once-through fuel cycle. The program was performed in a cooperative way between Brazilian and German partners. (orig.).

2450 (STUK-A–86) **Studies of potential severe accidents in Finnish nuclear power plants. Quarterly report 3. quarter 1987.** Aro, Ilari. Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland); Helsinki Univ. of Technology, Otaniemi (Finland). Jul 1989. 38p. Order Number DE90608737. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This thesis is based on six publications dealing with severe accident studies in Finnish nuclear power plants. Main emphasis has been put on general technical bases and methodologies applied in severe accident evaluation in Finland. As an example of the use of the analysis and evaluation methods, the analysis of one representative accident sequence, 'otal loss of AC power' has been presented for both Finnish power plant types. This accident sequence is required to be analyzed in the Finnish safety guide YVL 2.2 which deals with transient and accident analyses as a basis of technical solutions at nuclear powr plants. Two different analysis methods, MAAP 3.0 and MARCH 3/STCP have been used for receiving as complete a picture as possible of the flow of events and for verifying the models to some extent. Besides the use of the two different models, the method of sensitivity analysis has been used for evaluating the effects of some important technical parameters on the accident flow. Finally, conclusions of the applicability of the two methods for analyzing severe accident sequences in Finnish plants have been discussed.

2451 (STUK-B-YTO–54) **Operation of Finnish nuclear power plants. Quarterly report, 2. quarter 1988.** Koponen, H. and others. Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Dept. of Nuclear Safety. Dec 1988. 23p. Order Number DE90608738. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Same report published in Finnish as STUK-B-YTO–50.

This general review of the operation of the Finnish nuclear power plants concentrates on such events and discoveries related to nuclear and radiation safety as the regulatory body, the Finnish Centre for Radiation and Nuclear Safety, regards as noteworthy. The report also includes a summary of the radiation safety of the personnel and the environment, as well as tabulated data on the production and load factors of the plants. In the report period, no event essentially degraded plant safety nor posed a radiation hazard to the personnel or the environement.

2452 (STUK-B-YTO–56) **Operation of Finnish nuclear power plants. Quarterly report, 3. quarter 1988.** Koponen, H. and others. Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Dept. of Nuclear Safety. Feb 1989. 24p. Order Number DE90608739. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Same report published in Finnish as STUK-B-YTO–53.

This general review of the operation of the Finnish nuclear power plants concentrates on such events and discoveries related to nuclear and radiation safety as the regulatory body, the Finnish Centre for Radiation and Nuclear Safety, regards as noteworthy. The report also includes a summary of the radiation safety of the personnel and the environment, as well as tabulated data on the production and load factors of the plants. In the report period, no event essentially degraded plant safety nor posed a radiation hazard to the personnel or the environment.

2103 Power Reactors, Non-breeding, Graphite Moderated

Refer also to citation(s) 2503, 2504, 2815, 2979, 3476, 3477, 3746

2453 (JAERI–1318) **Heat and momentum transfer in a gas coolant flow through a circular pipe in a high temperature gas cooled reactor.** Ogawa, Masuro. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 49p. (In Japanese). Order Number DE90719604. Available from NTIS (US Sales Only), PC A03/MF A01.

In Japan Atomic Energy Research Institute (JAERI), a very high temperature gas cooled reactor (VHTR) has been researched and developed with a purpose of attaining a coolant temperature of around 1000degC at the reactor outlet. In order to design VHTR, comprehensive knowledge is required on thermo-hydraulic characteristics of laminar-turbulent transition, of coolant flow with large thermal property variation due to temperature difference, and of heat transfer deterioration. In the present investigation, experimental and analytical studies are made on a gas flow in a circular tube to elucidate the thermo-hydraulic characteristics. Friction factors and heat transfer coefficients in transitional flows are obtained. Influence of thermal property variation on the friction factor is qualitatively determined. Heat transfer deterioration in the turbulent flow subjected to intense heating is experimentally found to be caused by flow laminarization. The analysis based on a k-kL two-equation model of turbulence predicts well the experimental results on friction factors and heat transfer coefficients in flows with thermal property variation and in laminarizing flows. (author).

2454 (JAERI-M-89-064) **Study on shaft vibration of gas circulators with gas-bearings for HENDEL helium test facility.** Shimomura, Hiroaki; Kawaji, Satoshi; Fujisaki, Katsuo; Ihizuka, Takayuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 96p. (In Japanese). Order Number DE90719510. Available from NTIS (US Sales Only), PC A05/MF A01.

The gas circulator is a very important component in Gas-Cooled Reactor system. As the coolant helium gas of HTGR is low density, multi-stage compression or high-speed driving are required for the coolant circulator to produce the required head. The gas circulators for large scale HTGRs with mechanical and buffer-gas sealing in the shaft penetration had encountered troubles at the part more or less. On the other hand, smaller scale electric driven gas circulators with gas bearings as used for HENDEL and former DRAGON reactor enable fully encased construction and provide easier maintainability, however, those types of the circulator need highly precise machining, adjustment and superior operational techniques. Moreover, practical rotor weight seems to be limited up to around 150kg for the gas-bearing machinery. The fine dynamic mass-balancing of the rotor becomes extremely difficult in the large gas-bearing machine. The whirling phenomena of the journal tend to originate and to grow approaching the rotating frequency to the first bending natural frequency or the third critical speed of the rotor. In spite of many efforts and works on instability of the gas-bearing system, concrete or practical condition and countermeasure to the instability have not clarified. Present report describes the experimental result on shaft vibration and bearing characteristics of typical gas circulators among the five machines which have gas-bearings and are largest class in those types. It is clarified through the experiments that the fine dynamic balancing of the rotor, dynamic response of the bearing pads and gas-film thickness in the bearing clearance are extremely important to suppress the instability. However, it is also found that too much difficulties make them impractical in these machines. So one might conclude that the countermeasure with fine sensing technique of the half-speed whirling must be practical and useful. (author).

2455 (ORNL/FTR-3420) **[Safety related reactor physics calculation for HTGR type reactors]: Foreign trip report, October 3, 1989–October 7, 1989.** Cleveland, J.C. Oak Ridge National Lab., TN (USA). 21 Oct 1989. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002154. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

To address certain needs for validation data for gas-cooled reactors, a series of criticals are being planned at the PROTEUS facility at the Paul Scherrer Institute (PSI) in Wuerenlingen, Switzerland. The International Atomic Energy Agency is establishing a Coordinated Research Program (CRP) to provide a means for interested member countries to participate in the PROTEUS review.

2456 (PB-89-215453/XAB) **Environmental radionuclide concentrations in the vicinity of the peach bottom atomic power station: 1985-1986. Data report.** Domotor, S.L.; McLean, R.I. Maryland Power Plant Research Program, Annapolis, MD (USA). Jul 1989. 69p. (PPRP/PPER-R-11). Available from NTIS, PC A04/MF A01.

See also PB-88-192521.

High-resolution gamma spectroscopy was used to determine radionuclide concentrations in over 450 biota and sediment samples collected from the Susquehanna River-Chesapeake Bay system in the vicinity of the Peach Bottom Atomic Power Station (PBAPS) during 1985-1986. Low concentrations of PBAPS-related radionuclides (Zn65, Cs-134, and Cs-137) were detected in finfish, mussels, and crayfish. These PBAPS-related radionuclides and Co-60 were also detected in sediments. I-131 attributable to the Chernobyl reactor accident (April 26, 1986) was detected in environmental samples collected in May 1986. PBAPS-related radionuclide concentrations in biota and sediments represent small increments to the Susquehanna River-Chesapeake Bay system relative to natural and weapons test levels; radionuclide releases by PBAPS, and radiation doses to man, are well within regulatory limits.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 2259, 2481, 4183

2457 (BNL-43367) **Tensile and impact testing of an HFBR [High Flux Beam Reactor] control rod follower.** Czajkowski, C.J.; Schuster, M.H.; Roberts, T.C.; Milian, L.W. Brookhaven National Lab., Upton, NY (USA). Aug 1989. 92p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC02-76CH00016. Order Number DE90002310. Available from NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

The Materials Technology Group of the Department of Nuclear Energy (DNE) at Brookhaven National Laboratory (BNL) undertook a program to machine and test specimens from a control rod follower from the High Flux Beam Reactor (HFBR). Tensile and Charpy impact specimens were machined and tested from non-irradiated aluminum alloys in addition to irradiated 6061-T6 from the HFBR. The tensile test results on irradiated material showed a two-fold increase in tensile strength to a maximum of 100.6 ksi. The impact resistance of the irradiated material showed a six-fold decrease in values (3 in-lb average) compared to similar non-irradiated material. Fracture toughness (K_I) specimens were tested on an unirradiated compositionally and dimensionally similar (to HFBR follower) 6061 T-6 material with K_{max} values of 24.8 $\pm$ 1.0 Ksi$\sqrt{in}$ (average) being obtained. The report concludes that the specimens produced during the program yielded reproducible and believable results and that proper quality assurance was provided throughout the program. 9 figs., 6 tabs.

2458 (CONF-8909141-3) **Conversion feasibility studies for the Grenoble high flux reactor.** Mo, S.C.; Matos, J.E. Argonne National Lab., IL (USA). [1989]. 23p. Sponsored by U.S. Arms Control and Disarmament Agency; U.S. DOE Management & Administration. DOE Contract W-31109-ENG-38. From 12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989. Order Number DE90001442. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Feasibility studies for conversion of the High Flux Reactor (RHF) at Grenoble France have been performed at the Argonne National Laboratory in cooperation with the Institut Laue-Langevin (ILL). The uranium densities required for conversion of the RHF to reduced enrichment fuels were computed to be 7.9 g/cm^3 with 20% enrichment, 4.8 g/cm^3 with 29% enrichment, and 2.8 g/cm^3 with 45% enrichment. Thermal flux reductions at the peak in the heavy water reflector were computed to be 3% with 45% enriched fuel and 7% with 20% enriched fuel. In each case, the reactor's 44 day cycle length was preserved and no changes were made in the fuel element geometry. If the cladding thickness could be reduced from 0.38 mm to 0.30 mm, the required uranium density with 20% enrichment would be about 6.0 g/cm^3 and the thermal flux reduction at the peak in the heavy water reflector would be about 7%. Significantly higher uranium densities are required in the RHF than in heavy water reactors with more conventional designs because the neutron spectrum is much harder in the RHF. Reduced enrichment fuels with the uranium densities required for use in the RHF are either not available or are not licensable at the present time. 6 refs., 6 figs., 3 tabs.

2105 Power Reactors, Breeding

Refer also to citation(s) 2478, 2496, 2500, 2501, 2502, 2504, 2505, 2506, 2507, 2509, 2514, 2546, 2979, 4544

2459 (CONF-891103-34) **Thermal hydraulic analysis of fuel reprocessing Argon Cell accidents in the demonstration integral fast reactor.** Solbrig, C.W.; Forrester, R.J.; Phipps, R.D. Argonne National Lab., IL (USA). 1989. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE90001920. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The EBR-II and the heavily shielded hot cells of the fuel cycle facility at Argonne National Laboratory site in Idaho are being

equipped to demonstrate the practicality of the fuel cycle of the Integral Fast Reactor (IFR). This paper analyses atmosphere control accidents in the Argon Cell of the fuel cycle facility. 5 refs., 1 fig.

2460 (CONF-8910239–4) **Preparing a self-evaluation report for training program accreditation.** Driscoll, J.W. Argonne National Lab., Idaho Falls, ID (USA). [1989]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 13. annual TRADE conference; Baltimore, MD (USA); 22-25 Oct 1989. Order Number DE90002775. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This document describes the process used by Argonne National Laboratory (ANL) Training/Procedures personnel at Experimental Breeder Reactor 2 (EBR-II) to develop a Self-Evaluation Report for the Nuclear Power Plant Operator training program. The document also describes problems encountered and lessons learned during development of the Self-Evaluation Report. 5 refs., 2 tabs.

2461 (JAERI-M–89-060) **Fabrication of uranium-plutonium mixed carbide fuel pins for JMTR irradiation capsules, 84F-10A, 84F-12A and 87F-2A.** Arai, Yasuo; Iwai, Takashi; Maeda, Atsushi and others. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1989. 19p. (In Japanese). Order Number DE90719473. Available from NTIS (US Sales Only), PC A03/MF A01.

Five uranium-plutonium mixed carbide fuel pins were fabricated for the irradiation tests of JMTR in order to demonstrate performance of advanced fuels for FBR. Mixed carbide pellets with low densities (81-86 %TD) were packed in the cladding tubes of 316-type stainless steel having 9.4 mmD in outer diameter with one atmosphere of He gas. The characteristics of the fuel pellets prepared were well clarified. The performance of the fuel pins was confirmed by the inspections such as leak test, X-ray radiography, microscopy of welded section and check of surface contamination. (author).

2462 (JAERI-M–89-069) **Design study of high breeding fast reactor. FP gas purge/tube-in-shell metallic fuel fast reactor.** Hiraoka, Toru; Sako, Kiyoshi; Takano, Hideki; Osakabe, Masahiro; Ishii, Takeshi; Sato, Mitsuru; Hirota, Koichi; Konishi, Takao. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 214p. (In Japanese). Order Number DE90719530. Available from NTIS (US Sales Only), PC A10/MF A01.

Aiming to increase fuel breeding capability as the most essential feature of fast breeders, an idea of the FP gas purge/tube-in-shell type metallic fuel assembly is proposed. It makes volume fraction of fuel high as more than 50% and realizes a very hard neutron spectrum in the core. The structure of the fuel assembly, its fabrication and the FP gas purging mechanism were assessed and it is clarified that the new concept of the fuel assembly is engineeringly feasible. FP gas purging does not affect shielding structure and can be managed by a small scale cover-gas treatment system because of good trapping characteristics of bonding sodium in the assembly as expected. The fuel handling system without forced cooling is possible. Other reactor components such as IHX were also evaluated. Thus, a concept of the total reactor system of a fast breeding reactor of 670 MWe with the ultra-high breeding ratio of 1.84 and the short reactor doubling time of 6.7 years was obtained. (author).

2463 **Fuel/sodium reaction product formation in breached mixed-oxide fuel.** Bottcher, J.H.; Lambert, J.D.B.; Strain, R.V.; Ukai, S.; Shibahara, S. *Transactions of the American Nuclear Society (USA)*, 57: 86-88 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

The run-beyond-cladding-breach (RBCB) operation of mixed-oxide liquid-metal reactor fuel pins has been studied for 6 yr in the Experimental Breeder Reactor II (EBR-II) as part of a joint program between the US Department of Energy and the Power Reactor and Nuclear Fuel Development Corporation of Japan. The formation of fuel-sodium reaction product (FSRP), Na_3MO_4, where $M = U_{1-y}Pu_y$, in the outer fuel regions is the major phenomenon governing RBCB behavior. It increases fuel volume, decreases fuel stoichiometry, modifies fission product distributions, and alters thermal performance of a pin. This paper describes the morphology of Na_3MO_4 observed in 5.84-mm-diam pins covering a variety of conditions and RBCB times up to 150 effective full-power days (EFPDs).

2106 Power Reactors, Auxiliary, Mobile, Package, and Transportable

Refer also to citation(s) 2650, 2651, 2831, 3130

2464 (N–89-22981) **Megawatt class nuclear space power systems (MCNSPS) conceptual design and evaluation report. Volume 2, technologies 1: Reactors, heat transport, integration issues. Final report.** Wetch, J.R. Space Power, Inc., San Jose, CA (USA). Sep 1988. 143p. (NASA-CR–179614-VOL-2;NAS–1.26:179614-VOL-2;SPI–25-1-VOL-2). Available from NTIS, PC A07/MF A01.

The objectives of the Megawatt Class Nuclear Space Power System (MCNSPS) study are summarized and candidate systems and subsystems are described. Particular emphasis is given to the heat rejection system and the space reactor subsystem.

2107 Regulation and Licensing

Refer also to citation(s) 2195, 2248, 2482, 2536, 2538, 2540, 2543, 3594

2465 (GKSS–89/E/13) **Irradiation programs to establish the safety margins of German licensing rules related to RPV steel embrittlement.** Ahlf, J.; Bellmann, D.; Schmitt, F.J. GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). 1989. 17p. Available from Reprint from ASTM STP 1011, L.E. Steele (ed.), American Society for Testing and Materials, Philadelphia, 1989, p. 115-129.

Under German licensing rules, irradiation-induced embrittlement of a reactor pressure vessel (RPV) in the core belt region is taken into account basically by determining the shift of the 41-J transition temperature of the Charpy impact energy versus temperature curve and then adjusting either the exclusion line of the modified Porse diagram, or the K_{IR} curve, by this 41-J shift. The accuracy limits of $T_{41\ J}$ and $\Delta T_{41\ J}$ determination are discussed and quantified. The transition temperature concept is shown to be conservative in the validity range of the respective licensing rules because of the uncertainties in $\Delta T_{41\ J}$ determination. Investigations with respect to irradiation effects on fracture toughness deserve high priority in current programs. Results from a A 533-B^2 steel (HSST03) are presented, and the shift of the K_{Ic} curve is evaluated for two fluence levels. Experiments related to the question of whether neutron flux density has an influence on embrittlement are briefly reported. (orig.).

2466 (NUREG–0540-Vol.2-No.7) **Title list of documents made publicly available, July 1–31, 1989.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Oct 1989. 326p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A15/MF A01 - GPO - OSTI.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission. This information includes docketed material associated with civilian nuclear power plants and other uses of radioactive materials and nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information. Microfiche of the docketed information listed in the Title List is available for sale on a subscription basis from the National Technical Information Service (NTIS).

2467 (NUREG–0540-Vol.2-No.8) **Title list of documents made publicly available, August 1–31, 1989: Volume 2, No. 8.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Oct 1989. 349p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A15/MF A01 - GPO; OSTI; INIS.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and

generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index.

2468 (NUREG–0936-Vol.8-No.3) **NRC Regulatory Agenda: Quarterly report, July–September 1989.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Oct 1989. 128p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A07/MF A01 - GPO - OSTI.

The Regulatory Agenda is a quarterly compilation of all rules on which the NRC has recently completed action or has proposed, or is considering action and of all petitions for rulemaking that the NRC has received that are pending disposition.

2108 Economics

Refer also to citation(s) 2543

2469 (PB–89-873004/XAB) **Nuclear power plant decommissioning. January 1972-September 1989 (Citations from the NTIS data base). Report for January 1972-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 127p. Available from NTISPC N01/MF N01.

Supersedes PB–88-870043.

This bibliography contains citations concerning nuclear power plant phase-out and decommissioning. Included are case histories of the dismantling process, hazardous-waste management, site monitoring, and economic aspects of the phase-out. (This updated bibliography contains 249 citations, 71 of which are new entries to the previous edition.)

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory and Calculation

Refer also to citation(s) 2488, 3186, 4121

2470 (CEA-N–2605) **Parallel algorithms for solving the diffusion equation by finite elements methods and by nodal methods.** Coulomb, F. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. Jun 1989. 382p. (In French). Order Number DE90721137. Available from NTIS (US Sales Only), PC A17/MF A01.

The aim of this work is to study methods for solving the diffusion equation, based on a primal or mixed-dual finite elements discretization and well suited for use on multiprocessors computers; domain decomposition methods are the subject of the main part of this study, the linear systems being solved by the block-Jacobi method. The origin of the diffusion equation is explained in short, and various variational formulations are reminded. A survey of iterative methods is given. The elemination of the flux or current is treated in the case of a mixed method. Numerical tests are performed on two examples of reactors, in order to compare mixed elements and Lagrange elements. A theoretical study of domain decomposition is led in the case of Lagrange finite elements, and convergence conditions for the block-Jacobi method are derived; the dissection decomposition is previously the purpose of a particular numerical analysis. In the case of mixed-dual finite elements, a study is led on examples and is confirmed by numerical tests performed for the dissection decomposition; furthermore, after being justified, decompositions along axes of symmetry are numerically tested. In the case of a decomposition into two subdomains, the dissection decomposition and the decomposition with an integrated interface are compared. Alternative directions methods are defined; the convergence of those relative to Lagrange elements is shown; in the case of mixed elements, convergence conditions are found.

2471 (JAERI-M–89-091) **Thermal-hydraulics of actinide burner reactors. Conceptual study of actinide burner reactors, (3).** Takizuka, Takakazu; Mukaiyama, Takehiko; Takano, Hideki; Ogawa, Toru; Osakabe, Masahiro. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 43p. (In Japanese). Order Number DE90719606. Available from NTIS (US Sales Only), PC A03/MF A01.

As a part of conceptual study of actinide burner reactors, core thermal-hydraulic analyses were conducted for two types of reactor concepts, namely (1) sodium-cooled actinide alloy fuel reactor, and (2) helium-cooled particle-bed reactor, to examine the feasibility of high power-density cores for efficient transmutation of actinides within the maximum allowable temperature limits of fuel and cladding. In addition, calculations were made on cooling of actinide fuel assembly. (author).

2472 (ORNL/tr–89/40) **Horizontal cold source: Fluid dynamics tests on the moderator model in water and air current.** Hoffman, H.; Astruc, J.M. Oak Ridge National Lab., TN (USA). 1989. 37p. Translation of Re 972 N(p) 002, July 1982. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002281. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In addition to the vertical cold source, the high flux reactor is to have another cold source with a deuterium moderator level of 5 liters. At temperature levels of 25 K it produces neutrons in an energy range of < 5 MeV (velocities $\approx$ 600 m/s, wave lengths 6Å) for a variety of experiments. The position of the source must of necessity be horizontal. Inside it a quantity of heat of approximately 3 kW is released, a third of which comes from the moderator itself and two-thirds of which from the enclosure wall. It causes evaporation of the moderator fluid. The D_2 vapor released in this way ($\approx$ 10 g/s) is evacuated from the moderator cell and transported to a helium-cooled condenser, then returned to the source. The condenser is located approximately 4 m above the moderating cell. The D_2 circuit will operate according to the principle of a thermosiphon, which means that the fluid density differences are used to circulate the deuterium. 9 refs., 11 figs.

2473 (ORNL/tr–89/46) **Horizontal cold source friction losses of D_2 model with separate tubes comparison of calculated values to experimental results in D_2.** Hoffmann, H. Oak Ridge National Lab., TN (USA). 1989. 31p. Translation of Re 972 N(p) 031, March 1984. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002282. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Horizontal Cold Source will be located in the H5 channel and produces a quantity of heat of ca. 3 kW, a third of which comes from the moderator and two-thirds of which from the cell walls. Horizontal placement and the available space allow heat evacuation only by evaporation of the moderator, deuterium (saturation pressure: 1.5 bars, saturation temperature: 25 K). The D_2 vapor is transported in a monophase state or in a diphase mixture to the condenser, cooled by helium gas. The condensate and the liquid part of the diphase mixture are recirculated in the cell according to the principle of a thermosiphon. The condenser must be positioned at a sufficiently high level compared to the cell to produce a driving force (liquid column) in order to allow good circulation in the thermosiphon. 8 refs., 15 figs.

2474 **An S_2 synthetic acceleration scheme for the one-dimensional S_{sta} equations with linear discontinuous spatial differencing.** Lorence, L.J. Jr. (Sandia Labs., Albuquerque, NM (USA)); Morel, J.E.; Larsen, E.W. *Nuclear Science and Engineering (USA)*, 101(4): 341-351 (Apr 1989). DOE Contract AC04-76DP00789.

In this paper an S_2 synthetic acceleration scheme is developed for the one-dimensional S_n equations (slab and sphere) with linear discontinuous spatial differencing. A Fourier analysis shows that the scheme is unconditionally stable for a model problem. Computational results demonstrate the effectiveness of the technique for varying cell thickness and scattering anisotropy.

2202 Components and Accessories

Refer also to citation(s) 2259, 2446, 2479, 2510, 2525, 2545, 2820

2475 (INIS-BR–1695) **Computer-aided event tree analysis by the impact vector method.** Lima, J.E.P. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Posgraduacao de Engenharia. 1984. 248p. (In Portuguese). Order Number DE90608656. Available from NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS.

In the development of the Probabilistic Risk Analysis of Angra I, the ' large event tree/small fault tree' approach was adopted for the analysis of the plant behavior in an emergency situation. In this work, the event tree methodology is presented along with the adaptations which had to be made in order to attain a correct description of the safety system performances according to the selected analysis method. The problems appearing in the application of the methodology and their respective solutions are presented and discussed, with special emphasis to the impact vector technique. A description of the ETAP code ('Event Tree Analysis Program') developed for constructing and quantifying event trees is also given in this work. A preliminary version of the small-break LOCA analysis for Angra 1 is presented as an example of application of the methodology and of the code. It is shown that the use of the ETAP code sigmnificantly contributes to decreasing the time spent in event tree analyses, making it viable the practical application of the analysis approach referred above. (author).

2476 (SAND–89-1755C) **Loss-of-coolant accident (LOCA) testing of aged cables for nuclear plant life extension.** Jacobus, M.J. Sandia National Labs., Albuquerque, NM (USA). [1989]. 12p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-8910222–2: 17. water reactor safety information meeting, Rockville, MD (USA), 23-25 Oct 1989). Order Number DE90002103. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Sandia National Laboratories is conducting long-term aging research on representative samples of nuclear power plant Class 1E cables. The objectives of this program are to determine the suitability of these cables for extended life (beyond 40-year design basis) and to assess various cable condition monitoring (CM) techniques for predicting remaining cable life. Twelve different cable products have been aged for long times at relatively mild exposure conditions in three test chambers to nominal equivalent lifetimes of 20, 40, and 60 years. Following the aging process, the cables in each chamber were exposed to a sequential accident profile consisting of 110 Mrad of high dose rate gamma irradiation followed by a simulated design basis loss-of-coolant accident (LOCA) steam exposure (except the 20-year chamber, which has not yet been LOCA tested). This paper discusses the results of the LOCA testing on the cables aged to 60 years. Although some of the cables experienced electrical failures, the results of these tests indicate a good life extension potential for a number of popular cable products. 3 refs., 12 figs.

2203 Fuel Elements

Refer also to citation(s) 2164, 2488, 2508, 2534

2477 (IAERU–8802, pp. 101-117) **Neutron radiography of the irradiated nuclear fuels.** Tsuruno, Akira (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Mar 1989. (In Japanese). (CONF-8806441–: 4. IAERU seminar, Tokyo (Japan), 18 Jun 1988). In *Proceedings of IAERU seminar-4.* Order Number DE90705939. Available from NTIS (US Sales Only), PC A07/MF A01.

Application of neutron radiography in the post-irradiation nondestructive examination of highly activated materials was realized early 1965. There were some reasons, (1) thermal neutrons penetrate easily heavy metals like uranium, (2) by the transfer method the effect of fogging radiation except neutrons can be avoided, (3) presence of research reactors for thermal neutron source. At JAERI, the post-irradiation non-destructive examination in JRR-3 neutron radiography facility was started at 1975. The highly activated materials which were metal natural uranium spent fuels, uranium oxide pellets and mixed oxide pellets in the irradiated capsules, had been transfered from the hot laboratory to the JRR-3 neutron radiography facility. In this report, some examples in the post-irradiation non-destructive examination are given. (author).

2204 Control Systems

Refer also to citation(s) 2247, 2537

2478 (CONF-890555–23) **Faster-than-real-time simulation for plant control.** Larson, H.A.; Dean, E.M.; Lehto, W.K. Argonne National Lab., Idaho Falls, ID (USA). [1989]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 7. power plant dynamics, control and testing symposium; Knoxville, TN (USA); 15-17 May 1989. Order Number DE90002195. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

As part of the advanced diagnostic prognostic analysis and control system, a faster-than-real-time simulation of the EBR-II reactor has been developed using the Digital Simulator for Nuclear Power Plants (DSNP). Other elements of the system include an expert system, advanced graphics display, real time data acquisition using the EBR-II plant computer and a data transmission system coupling the control computers with the plant and graphics display. Various plant models have been constructed with even the most complicated being able to run plant transients in less-than-real-time. This paper discusses the plant models, necessary code modifications and the results. Depending on degree of model complexity the plant simulations run from 0.067 to 0.75 of the transient time. 6 refs., 1 tab.

2479 (CONF-8910222–6) **Evaluation of check valve monitoring methods.** Haynes, H.D. Oak Ridge National Lab., TN (USA). [1989]. 31p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 17. water reactor safety information meeting; Rockville, MD (USA); 23-25 Oct 1989. Order Number DE90002482. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Check valves are used extensively in nuclear plant safety systems and balance-of-plant (BOP) systems. Their failures have resulted in significant maintenance efforts and, on occasion, have resulted in water hammer, overpressurization of low-pressure systems and damage to flow system components. Consequently, in recent years check valves have received considerable attention by the Nuclear Regulatory Commission (NRC) and the nuclear power industry. Oak Ridge National Laboratory (ORNL) is carrying out a comprehensive two phase aging assessment of check valves in support of the Nuclear Plant Aging Research (NPAR) program. As part of the second phase, ORNL is evaluating several developmental and/or commercially available check valve diagnostic monitoring methods; in particular, those based on measurements of acoustic emission, ultrasonics, and magnetic flux. These three methods were found to provide different (and complementary) diagnostic information. The combination of acoustic emission with either ultrasonic or magnetic flux monitoring yields a monitoring system that succeeds in providing sensitivity to detect all major check valve operating conditions. All three methods are still under development and should improve in many respects as a result of further testing and evaluation. 10 refs., 19 figs., 1 tab.

2480 (EGG-M–88288) **Where to from here? Future applications of mental models of complex performance.** Hahn, H.A.; Nelson, W.R.; Blackman, H.S. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 2p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881058–7: Human Factors Society annual meeting, Anaheim, CA (USA), 24-28 Oct 1988). Order Number DE90002091. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The purpose of this paper is to raise issues for discussion regarding the applications of mental models in the study of complex performance. Applications for training, expert systems and decision aids, job selection, workstation design, and other complex environments are considered. 1 ref.

2481 (ORNL/FTR–3451) **[Haiden Reactor Project and DOE's Advanced Controls Program: Foreign trip report, October 16, 1989–October 22, 1989.** White, J.D. Oak Ridge National Lab., TN (USA). 6 Nov 1989. 8p. Sponsored by U.S. DOE Nuclear

Energy. DOE Contract AC05-84OR21400. Order Number DE90002659. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Halden research facility in Norway was visited to discuss whether Halden's research would be useful for the Advanced Controls Program. Human-machine research at the Halden might be used to accelerate progress or to lower the cost of the DOE Advanced Controls Program at ORNL

2482 **Reactor Safety Assessment System.** Sebo, D.E. (Idaho National Engineering Lab., Idaho Falls, ID (US)); Bray, M.A.; King, M.A. pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

The Reactor Safety Assessment System (RSAS) is an expert system under development for the United States Nuclear Regulatory Commission (USNRC). RSAS is designed for use at the USNRC Operations Center in the event of a serious incident at a licensed nuclear power plant. RSAS is a situation assessment expert system which uses plant parametric data to generate conclusions for use by the NRC Reactor Safety Team. RSAS uses multiple rule bases and plant specific setpoint files to be applicable to all licensed nuclear power plants in the United States. RSAS currently covers several generic reactor categories and multiple plants within each category.

2483 **Incorporating fuzzy data and logical relations in the design of expert systems for nuclear reactors.** Guth, M.A.S. (Oak Ridge National Lab., Oak Ridge, TN (US)). pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

This paper applies the method of assigning probability in Dempster-Shafer Theory (DST) to the components of rule-based expert systems used in the control of nuclear reactors. Probabilities are assigned to premises, consequences, and rules themselves. This paper considers how uncertainty can propagate through a system of Boolean equations, such as fault trees or expert systems. The probability masses assigned to primary initiating events in the expert system can be derived from observing a nuclear reactor in operation or based on engineering knowledge of the reactor parts. Use of DST mass assignments offers greater flexibility to the construction of expert systems in two important respects. First, DST mass assignments have the advantage over classical probability methods of accommodating when necessary uncommitted probability assignments. Thus the DST probability framework can incorporate expert system inputs from imprecise or fuzzy data. Second, DST applied to the Boolean rules themselves leads to a probabilistic logic, where a given rule may be valid with probability less than unity: fuzzy logical rules.

2484 **Prolgraf-B: A knowledge-based system for the automated construction of nuclear plant diagnostic models. .** Guarro, S.B. (Lawrence Livermore National Lab., Livermore, CA (US)). pp. 910 of Artificial intelligence and other innovative computer applications in the nuclear industry. Majumdar, M.C.; Majumdar, D.; Sackett, J.I American Nuclear Society, La Grange Park, IL (1987). (CONF-870832–: Topical meeting on artificial intelligence and other innovative computer applications in the nuclear industry: present and future, Snowbird, UT (USA), 31 Aug - 2 sep 1987).

Automated diagnosis of undesired operational transients in a nuclear power plant process has been an active subject of research for the last ten years. Examples of different approaches to the solution of this problem are the early research on Disturbance Analysis Systems (DASs) and the more recent developments in the area of Automated Emergency Operating Procedures (AEOPs). The early efforts in the field of automated plant process analysis were hindered by the scarcity of efficient modeling tools suits for self-contained representation of typical target processes. For example, the cause-consequence tree methodology used in the DAS prototypes produced event-oriented models. This type of representation required a separate model development effort for each individual event sequence for which a diagnostic capability was desired. The resulting models often lacked flexibility, in that even relatively small deviations of an actual occurrence from a modeled event sequence could compromise the capability by the model and the associated diagnostic software to match and recognize the sequence. A discrete modeling approach, called the Logic Flowgraph Methodology (LFM) and designed to overcome some of these difficulties, has been developed and interaction to be defined as a function of the combination of the vector states of the influencing variables.

2205 Environmental Aspects

Refer also to citation(s) 2456, 2497, 2529, 2542, 2549, 3502, 3594

2485 (EGG-M–34487) **Verification of the ORIGEN2 code analysis for the TMI-2 reactor core.** Akers, D.W.; Schnitzler, B.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8806143–10: Nuclear reactor severe accident chemistry symposium, Toronto (Canada), 5-10 Jun 1988). Order Number DE90002017. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Accurate definition of the fission product inventories produced in the TMI-2 reactor prior to the accident on March 29, 1979 are of considerable interest to many organizations including the Department of Energy which is shipping the damage reactor core to the Idaho National Engineering Laboratory and conducting the TMI-2 reactor examination program, and General Public Utilities which is defueling the reactor. Numerous fission product inventory calculations have been performed for the TMI-2 core, including an ORIGEN2 analysis by EG&G which uses 1239 nodes to define burnup in the reactor core. To provide a verification of the predicted fission product inventories, a measurement study was performed using pellets from various core regions. Measurements were performed for transuranics, burnup monitors, noble gases, principal gamma ray emitters, ^{129}I, and ^{90}Sr. Comparisons between the experimental results and the code analyses are presented with an evaluation of the associated uncertainties. Also, a discussion is presented of the probable causes of the observed differences between the code and measured values. 10 refs., 1 fig., 2 tabs.

2486 (EGG-M–88154) **Fission product relocation and behavior in the TMI-2 reactor vessel.** Akers, D.W.; McCardell, R.K. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 21p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881024–16: TMI-2 accident materials behavior, plant technology and recovery, Washington, DC (USA), 30 Oct - 4 nov 1988). Order Number DE90002009. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The purpose of this paper is to summarize the results of the fission product examinations performed on samples from the TMI-2 reactor vessel and to evaluate the chemistry that resulted in the observed behavior. As part of the TMI-2 core examination program, samples were examined from all regions within the reactor vessel, from leadscrews in the top head to prior molten material relocated to the lower plenum of the reactor vessel during the accident. These results indicated significant variations in fission product behavior that were generally consistent with the volatility and chemical behavior of the fission product species. Low volatility species were retained almost entirely in the fuel material matrix (^{144}Ce), whereas unoxidized species (e.g., ^{125}Sb) were found with the metallic structural materials, and there was a significant release of the high volatile species (^{137}Cs and ^{129}I) from the high temperature portions of the fuel. 15 refs., 1 fig., 5 tabs.

2487 (INIS-BR–1744) **Internal progress report of operational environmental monitoring in the region of Pocos de Caldas, MG, Brazil.** Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil). [1989]. 55p. (In Portuguese). Order Number DE90608322. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The operational environmental monitoring plan, done by Instituto de Radioprotecao e Dosimetria (IRD), for Pocos de Caldas region (CIPC) and used until today is described.

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 2259, 2455, 2458, 2459, 2477, 2478, 2500, 2505, 2506, 2507, 2509, 2514, 2517, 2521, 2528, 2979, 3042

2488 (CONF-8909141–7) **The conversion of the 2 MW reactor at the Rhode Island Nuclear Science Center.** DiMeglio, A.F.; Matos, J.E.; Freese, K.E.; Spring, E.F. Argonne National Lab., IL (USA). [1989]. 11p. Sponsored by U.S. Arms Control and Disarmament Agency; U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies; U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989. Order Number DE90001759. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The 2 MW Rhode Island Atomic Energy Commission reactor is required to convert from the use of High Enriched Uranium (HEU) fuel to the use of Low Enriched Uranium (LEU) fuel using a standard LEU fuel plate which is thinner and contains more U-235 than the current HEU plate. These differences, coupled with a desire to upgrade the characteristics and capability of the reactor, have resulted in core design studies and thermal hydraulic studies not only at the current 2 MW but also at the maximum power level of the reactor, 5 MW. In addition, during 23 years of operation, it has become clear that the main uses of the reactor have been neutron scattering and neutron activation analysis. The requirement to convert to LEU presents and opportunity to optimize the core for the utilization and to restudy the thermal hydraulics using modern techniques. This paper presents the current conclusions of both aspects. 2 refs., 9 figs.

2489 (CONF-8909141–8) **Interpretation of gamma-scanning data from the ORR demonstration elements.** Bretscher, M.M.; Snelgrove, J.L.; Hobbs, R.W. Argonne National Lab., IL (USA). [1989]. 34p. Sponsored by U.S. Arms Control and Disarmament Agency; U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies. DOE Contract W-31109-ENG-38. From 12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989. Order Number DE90001761. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The HEU and LEU fuel elements used in the ORR whole-core demonstration were gamma-scanned to determine the axial distribution of the ^{140}La and ^{137}Cs activities. Analysis of this data is now complete. From the ^{140}La activity distributions cycle-averaged powers were determined while the ^{137}Cs data provided a measure of the final ^{235}U burnup in the fuel elements. A method for calculating correction factors for activity gradients transverse to the fuel element axis is presented and is applied to the first mixed core used in the demonstration during the gradual transition to an all LEU core. Results based on the gamma-scanning of the LEU fuel followers are also presented. Improved burnup calculations against which the experimental results are to be compared are now in progress. 7 refs., 21 figs., 3 tabs.

2490 (EGG-M–88270) **Neutronics design of the INEL [Idaho National Engineering Laboratory] facility for boron neutron capture therapy clinical trials.** Parsons, D.K.; Wheeler, F.J.; Rushton, B.L.; Nigg, D.W. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-880911–35: International reactor physics conference, Jackson Hole, WY (USA), 18-21 Sep 1988). Order Number DE90002010. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The PBF reactor at INEL has been redesigned for BNCT treatment of Gliobiastoma Multiforme. Analysis indicates that the design goals of 1.0E + 10 n/cm^2·s epithermal neutron flux at the beam port can be met without exceeding the design goals of 2.6E -11 J cGy/(n/cm^2) for the fast neutron KERMA and 2.0E-11 cGy/(n/cm^2) for the gamma KERMA. These design goals result in a 10 minute patient treatment time with low nondesirable doses. 12 refs., 5 figs., 1 tab.

2491 (JAERI-M–89-080) **Stabilities of dimension and thermal-resistance of ASR-ORB carbon for thermal barrier materials of HTTR.** Matsuo, Hideto; Saito, Tamotsu; Imai, Hisashi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 22p. (In Japanese). Order Number DE90719539. Available from NTIS (US Sales Only), PC A03/MF A01.

Dimensional stability as well as thermal-resistivity is one of the important properties for thermal barrier materials to be used in the High-Temperature Engineering Test Reactor (HTTR). Changes in these properties under the reactor operation condition were estimated on ASR-ORB carbon selected as the thermal barrier material. Stabilities of these properties were evaluated from the experimental results and graphitization behavior of the carbon crystallite by heat-treatment. It is indicated that during the reactor operation the dimension shrinkage of the material will be less than 0.1 per cent and that change in the thermal-resistance will remain within the sample-to-sample variation. (author).

2492 (ORNL/TM–11335) **Job/task analysis for I&C [Instrumentation and Controls] instrument technicians at the High Flux Isotope Reactor.** Duke, L.L. Oak Ridge National Lab., TN (USA). Sep 1989. 41p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90001847. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

To comply with Department of Energy Order 5480.XX (Draft), a job/task analysis was initiated by the Maintenance Management Department at Oak Ridge National Laboratory (ORNL). The analysis was applicable to instrument technicians working at the ORNL High Flux Isotope Reactor (HFIR). This document presents the procedures and results of that analysis. 2 refs., 2 figs.

2207 Plutonium and Isotope Production Reactors

Refer also to citation(s) 2527, 2528, 2979

2208 Propulsion Reactors

2493 **Space applications of fusion energy.** Roth, J.R. (Tennessee Univ., Knoxville, TN (USA). Dept. of Electrical and Computer Engineering). *Fusion Technology (USA)*, 15(3): 1375-1394 (May 1989).

When more than a few hundred kilowatts of steady-state power are required for space applications, the only feasible choices appear to be nuclear fission or nuclear fusion. Space applications places different and usually more stringent constraints on the choice of fusion reactions and fusion confinement systems than do ground-based electric utility applications. These constraints are addressed in this paper. Desirable characteristics of fusion reactors for space are discussed.

2494 **Survivable pulse power space radiator.** Mims, J.; Buden, D.; Williams, K. To Dept. of Energy, Washington, DC. USA Patent 4,832,113. 23 May 1989. Filed date 11 Mar 1988. USA Patent Application 7 167,203. Int. Cl. B64G 1/50;B64G 1/56;B64G 1/44. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a thermal radiator system for use on an outer space vehicle, which must survive a long period of nonuse and then radiate large amounts of heat for a limited period of time. The radiator includes groups of radiator panels that are pivotally connected in tandem, so that they can be moved to deployed configuration wherein the panels lie largely coplanar, and to a stowed configuration wherein the panels lie in a stack to resist micrometeorite damage. The panels are mounted on a boom which separates a hot power source from a payload. While the panels are stowed, warm fluid passes through their arteries to keep them warm enough to maintain the coolant in a liquid state and avoid embrittlement of material.

2209 Reactor Safety

Refer also to citation(s) 2195, 2459, 2460, 2468, 2476, 2479, 2481, 2482, 2485, 2486, 2616, 2805, 3039, 3132, 3209, 3476, 3477, 3481, 3594, 3746, 4519

2495 (BMU–1989-226) **Measures for reduction of severe accident consequences: Comprehensive evaluation of the results sponsored by the BMI.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien,

Gutachten. Bracht, K.; Friedrichs, H.G. Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.). 1989. 84p. (In German). Contract BMU SR 361. Available from Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

A number of analytical studies were initial in the past by the Federal Ministry of Interior (BMI) of FRG, to investigate the potential of additional constructive measures for risk reduction. Those measures were proposed especially against uncontrolled overpressurization of the containment due to continuous gas/steam generation, penetration of the foundation of the reactor building by melt-concrete interaction, and failure of the containment due to violent hydrogen combustion. This report gives an overview about those studies and summarizes their results. Concerning uncontrolled overpressurization, only filtered venting may be a reasonable measure, while it seems to make not much sense, to look at measures against penetration of the foundation like 'core-catcher' in further detail. To prevent hydrogen combustion with severe consequences, several potential possibilities exist, but none of them can be considered as a safe measure. Additional analysis concerning hydrogen distribution and combustion in a multi-compartment containment are necessary. All studies mentioned in this report, deal with additional constructive measures to mitigate the consequences of severe accidents. Up to day in FRG, the potential of accident prevention and mitigation of its consequences by still or again operable and already existing systems of a plant have not been investigated in detail. As indicated by first results, the use of those systems in the frame of an appropriate accident management may have a large potential for risk reduction. (orig.).

2496 (BNL–43298) **Development and Testing of a RETRAN/MINET composite code and application to the J.A. Fitzpatrick plant.** Van Tuyle, G.J.; Rohatgi, U.S.; Aronson, A.L.; Chan, B.C.; Mallen, A.N.; Szwarc, K.; Karasulu, M. Brookhaven National Lab., Upton, NY (USA). 1989. 27p. Sponsored by Electric Power Research Institute. DOE Contract AC02-76CH00016. (CONF-8909248–1: 6. international RETRAN meeting, Arlington, VA (USA), 18-20 Sep 1989). Order Number DE90001533. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The development and testing of the RETRAN/MINET Composite Code, based on RETRAN 02 Mod 3 and MINET Version 1.10, are described. The MINET Code was originally developed for the analysis of complex balance of plant (BOP) thermal-hydraulic systems and already serves that purpose in support of RAMONA-3B for BWR analyses and SSC for LMR analyses. The object in developing RETRAN/MINET was to extend the degree to which complex thermal-hydraulic systems can be analyzed, while providing the capability to use detailed RETRAN modeling of the reactor and other components, where needed. Preliminary testing established proper code performance and data transmission, as well as stability under transient conditions. Two test transients postulated for the H.B. Robinson Plant were simulated using a two loop RETRAN/MINET representation extending to the condenser, and the results were compared against those generated using RELAP5. In addition, the RETRAN model was extended directly to the condenser and the transients were re-run. This provided for a three-way comparison between RETRAN/MINET, RELAP5, and RETRAN (alone). The results generated using RETRAN/MINET and RETRAN were very similar, which again indicates that the interface in performing correctly. The RETRAN/MINET representation through the feedwater train excuted about 20% faster than in the RETRAN (alone) case, although more substantial improvements are expected for more complex systems. The principal objective of establishing correct performance of the composite code has been achieved. 9 refs., 19 figs.

2497 (CEA-DAS–539) **International cooperation for operating safety.** Dupuis, M.C. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Mar 1989. 11p. (In French). (CONF-881014–: International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety, Avignon (France), 2-7 Oct 1988). Order Number DE90721233. Available from NTIS (US Sales Only), PC A03/MF A01.

The international-cooperation organization in nuclear safety domain is discussed. The nuclear energy Direction Committee is helped by the Security Committee for Nuclear Power Plants in the cooperation between security organizations of member countries and in the safety and nuclear activity regulations. The importance of the cooperation between experts in human being and engine problems is underlined. The applied methods, exchange activities and activity analysis, and the cooperation of the Nuclear Energy Agency and international organizations is analysed.

2498 (CEA-DAS–603) **Trend and pattern analysis of operational data through cooperation between OECD countries.** Dupuis, M.C. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. May 1989. 11p. (CONF-8904156–: CSNI-CEC specialist meeting on trends and pattern analyses of operational data from nuclear power plants, Rome (Italy), 3-7 Apr 1989). Order Number DE90721101. Available from NTIS (US Sales Only), PC A03/MF A01.

This paper deals with trend analyses achieved by NEA/OECD countries to assess operational safety experience. It describes the main features of the incident Reporting System operated by NEA to collect relevant safety events from nuclear power plants. It presents the results of exchange methods within Principal Working Group no 1 in charge of operating experience and human factors; the use of preselected IRS incidents is illustrated by the study of losses of containment functions performed by PWGI; some trends resulting from enlarged international exchanges dealing with operational data are highlighted through two examples: reducing scram frequency and improving technical specifications.

2499 (CNEN-DR–112/82) **Procedure to estimate radiation dose in the population in the case of an accident.** Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores. Jul 1982. 40p. (In Portuguese). Order Number DE90608312. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The methods to estimate radiation doses in the population due to nuclear power plants accidents are presented.

2500 (CONF-890673–5) **LMR design to facilitate control.** Planchon, H.P.; Golden, G.H.; Sackett, J.I.; Singer, R.M.; Mohr, D.; Chang, L.K.; Vilim, R.B.; Feldman, E.E. Argonne National Lab., IL (USA). 1989. 20p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From IWGFR specialists meeting on advanced controls for fast reactors; Argonne, IL (USA); 20-22 Jun 1989. Order Number DE90002211. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent testing in the Experimental Breeder Reactor-II (EBR-II) has demonstrated the potential for passively accomplishing basic reactor safety functions. Tests have shown that reactor feedbacks can safely shut down the reactor for loss of flow and loss of heat sink accidents and that natural convection can subsequently cool the reactor without aid of active components. Analysis has indicated that passive safety for the transient overpower and loss of coolant events can also be achieved for a larger LMR with metal fuel. The analyses and experiments suggest that there will be both special constraints and opportunities for the design of automatic control and protection systems for inherently safe reactor plants. The constraints are generally a restriction on the "control band" of active components so that they cannot override the reactivity feedbacks, or natural convective heads which otherwise inherently carry out the safety functions. The opportunities for improvement of reactor controls are generally in two areas. First the complexity of safety systems (which evolves from the philosophy of safety reliability through redundancy, diversity and independence) can be reduced. The reliability and diverse nature of passive shutdown, convective heat removal and hydrostatic mitigation of leaks in the primary boundary allow considerable simplification or deletion of active control and protection system, while at the same time improving reliability of the safety functions. 10 refs., 4 figs.

2501 (CONF-890841–3) **Safety aspects of the US advanced LMR [liquid metal reactor] design.** Pedersen, D.R.; Gyorey, G.L.; Marchaterre, J.F.; Rosen, S. Argonne National Lab., IL (USA). 1989. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From International workshop on

safety of nuclear installations of the next generation and beyond; Chicago, IL (USA); 28-31 Aug 1989. Order Number DE90002175. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The cornerstones of the United States Advanced Liquid Metal Cooled Reactor (ALMR) program sponsored by the Department of Energy are: the plant design program at General Electric based on the PRISM (Power Reactor Innovative Small Module) concept, and the Integral Fast Reactor program (IFR) at Argonne National Laboratory (ANL). The goal of the US program is to produce a standard, commercial ALMR, including the associated fuel cycle. This paper discusses the US regulatory framework for design of an ALMR, safety aspects of the IFR program at ANL, the IFR fuel cycle and actinide recycle, and the ALMR plant design program at GE. 6 refs., 5 figs.

2502 (CONF-890841–4) **Safety aspects of the IFR pyroprocess fuel cycle.** Forrester, R.J.; Lineberry, M.J.; Charak, I.; Tessier, J.H.; Solbrig, C.W.; Gabor, J.D. Argonne National Lab., IL (USA). [1989]. 25p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From International workshop on safety of nuclear installations of the next generation and beyond; Chicago, IL (USA); 28-31 Aug 1989. Order Number DE90002177. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper addresses the important safety considerations related to the unique Integral Fast Reactor (IFR) fuel cycle technology, the pyroprocess. Argonne has been developing the IFR since 1984. It is a liquid metal cooled reactor, with a unique metal alloy fuel, and it utilizes a radically new fuel cycle. An existing facility, the Hot Fuel Examination Facility-South (HFEF/S) is being modified and equipped to provide a complete demonstration of the fuel cycle. This paper will concentrate on safety aspects of the future HFEF/S operation, slated to begin late next year. HFEF/S is part of Argonne's complex of reactor test facilities located on the Idaho National Engineering Laboratory. HFEF/S was originally put into operation in 1964 as the EBR-II Fuel Cycle Facility (FCF) (Stevenson, 1987). From 1964–69 FCF operated to demonstrate an earlier and incomplete form of today's pyroprocess, recycling some 400 fuel assemblies back to EBR-II. The FCF mission was then changed to one of an irradiated fuels and materials examination facility, hence the name change to HFEF/S. The modifications consist of activities to bring the facility into conformance with today's much more stringent safety standards, and, of course, providing the new process equipment. The pyroprocess and the modifications themselves are described more fully elsewhere (Lineberry, 1987; Chang, 1987). 18 refs., 5 figs., 2 tabs.

2503 (CONF-890855–57) **Analysis of fluid-structure interaction and structural response of Chernobyl-4 reactor.** Wang, C.Y.; Pizzica, P.A.; Gvildys, J.; Spencer, B.W. Argonne National Lab., IL (USA). [1989]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 10. international conference on Structural Mechanics in Reactor Technology (SMIRT); Anaheim, CA (USA); 14-18 Aug 1989. Order Number DE90001770. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

On April 26, 1986, an accident occurred at the Chernobyl-4 Nuclear Power Plant in the Soviet Union. A post accident meeting was held in Vienna during the week of August 25, 1986. In mid-July 1986, the DOE formed a team to analyze the accident, including experts from the national laboratories such as Argonne National Laboratory, Brookhaven National Laboratory, Oak Ridge National Laboratory, and Pacific Northwest Laboratory. The goal was to assess the information's plausibility, provided analytical support to the US delegation during the post-accident review meeting and obtain a technical understanding of the accident. Detailed analyses of the team work are given in Ref. 1 (DOE, 1986). The accident at Chernobyl-4 occurred during the running of a test to determine a turbogenerator's ability to provide in-house emergency power after shutting off its steam supply. The accident was the result of a large, destructive power excursion. The major design related factor in the accident was the large positive void coefficient of reactivity. This feature, not present in the US reactors, means that an increase in power is likely to lead to an increase in reactivity which will further increase power, and finally result in the destructive accident. 5 refs., 11 figs.

2504 (CONF-890855–58) **Advancements in the behavioral modeling of fuel elements and related structures.** Billone, M.C.; Montgomery, R.O.; Rashid, Y.R.; Head, J.L. Argonne National Lab., IL (USA). 1989. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 10. international conference on Structural Mechanics in Reactor Technology (SMIRT); Anaheim, CA (USA); 14-18 Aug 1989. Order Number DE90001768. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An important aspect of the design and analysis of nuclear reactors is the ability to predict the behavior of fuel elements in the adverse environment of a reactor system. By understanding the thermomechanical behavior of the different materials which constitute a nuclear fuel element, analysis and predictions can be made regarding the integrity and reliability of fuel element designs. The SMiRT conference series, through the division on fuel elements and the post-conference seminars on fuel element modeling, provided technical forums for the international participation in the exchange of knowledge concerning the thermomechanical modeling of fuel elements. This paper discusses the technical advances in the behavioral modeling of fuel elements presented at the SMiRT conference series since its inception in 1971. Progress in the areas of material properties and constitutive relationships, modeling methodologies, and integral modeling approaches was reviewed and is summarized in light of their impact on the thermomechanical modeling of nuclear fuel elements. 34 refs., 5 tabs.

2505 (CONF-890899–2) **Expert system applications in support of system diagnostics and prognostics at EBR-II.** Lehto, W.K.; Gross, K.C. Argonne National Lab., IL (USA). 1989. 27p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Joint Korea-United States seminar on expert systems for electric power systems and industries; Seoul (Republic of Korea); 13-18 Aug 1989. Order Number DE90002171. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Expert systems have been developed to aid in the monitoring and diagnostics of the Experimental Breeder Reactor-II (EBR-II) at the Idaho National Engineering Laboratory (INEL) in Idaho Falls, Idaho. Systems have been developed for failed fuel surveillance and diagnostics and reactor coolant pump monitoring and diagnostics. A third project is being done jointly by ANL-W and EG&G Idaho to develop a transient analysis system to enhance overall plant diagnostic and prognostic capability. The failed fuel surveillance and diagnosis system monitors, processes, and interprets information from nine key plant sensors. It displays to the reactor operator diagnostic information needed to make proper decisions regarding technical specification conformance during reactor operation with failed fuel. 8 refs., 9 figs., 2 tabs.

2506 (CONF-891140–3) **SASSYS validation with the EBR-II shutdown heat removal tests.** Herzog, J.P. Argonne National Lab., IL (USA). 1989. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Session on thermal-hydraulic aspects of passive safety and new generalization reactors; San Francisco, CA (USA); 27-30 Nov 1989. Order Number DE90001924. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

SASSYS is a coupled neutronic and thermal hydraulic code developed for the analysis of transients in liquid metal cooled reactors (LMRs). The code is especially suited for evaluating of normal reactor transients – protected (design basis) and unprotected (anticipated transient without scram) transients. Because SASSYS is heavily used in support of the IFR concept and of innovative LMR designs, such as PRISM, a strong validation base for the code must exist. Part of the validation process for SASSYS is analysis of experiments performed on operating reactors, such as the metal fueled Experimental Breeder Reactor – II (EBR-II). During the course of a series of historic whole-plant experiments, EBR-II illustrated key safety features of metal fueled LMRs. These experiments, the Shutdown Heat Removal Tests (SHRT), culminated in unprotected loss of flow and loss of heat sink transients from full power and flow. Analysis of these and earlier SHRT experiments constitutes a vital part of SASSYS validation, because it facilitates scrutiny of specific SASSYS models and of integrated code capability. 12 refs., 11 figs.

2507 (CONF-891140–4) **Inherent controllability in modular ALMRs.** Sackett, J.I.; Sevy, R.H.; Wei, T.Y.C. Argonne National Lab., IL (USA). 1989. 13p. Sponsored by U.S. DOE Nuclear

Energy. DOE Contract W-31109-ENG-38. From Session on thermal-hydraulic aspects of passive safety and new generalization reactors; San Francisco, CA (USA); 27-30 Nov 1989. Order Number DE90001922. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

As part of recent development efforts on advanced reactor designs ANL has proposed the IFR (Integral Fast Reactor) concept. The IFR concept is currently being applied to modular sized reactors which would be built in multiple power paks together with an integrated fuel cycle facility. It has been amply demonstrated that the concept as applied to the modular designs has significant advantages in regard to ATWS transients. Attention is now being focussed on determining whether or not those advantages deriving from the traits of the IFR can be translated to the operational/DBA (design basis accident) class of transients. 5 refs., 3 figs., 3 tabs.

2508 (CONF-8907161–1) **Critical time step estimation for three-dimensional explicit impact analysis.** Kulak, R.F. Argonne National Lab., IL (USA). [1989]. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Structures under shock and impact conference; Cambridge, MA (USA); 11-13 Jul 1989. Order Number DE90002187. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A method to obtain a bound on the critical time step of impact problems that employ explicit integration and penalty type contact elements is presented. The method uses a Gerschgorin bound obtained from a partially assembled stiffness matrix for the nodes that belong to elements involved in the contact region. A numerical example is presented to illustrate the method's effectiveness. 6 refs., 4 figs., 1 tab.

2509 (CONF-8909263–1) **Fission energy: The integral fast reactor.** Chang, Yoon I. Argonne National Lab., IL (USA). [1989]. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 6. edition of the University of Gandia summer colloquium; Valencia (Spain); 4-9 Sep 1989. Order Number DE90001760. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Integral Fast Reactor (IFR) is an innovative reactor concept being developed at Argonne National Laboratory as a such next-generation reactor concept. The IFR concept has a number of specific technical advantages that collectively address the potential difficulties facing the expansion of nuclear power deployment. In particular, the IFR concept can meet all three fundamental requirements needed in a next-generation reactor as discussed below. This document discusses these requirements.

2510 (CONF-8910222–3) **Power reactor embrittlement data base.** Kam, F.B.K.; Stallmann, F.W.; Wang, J.A. Oak Ridge National Lab., TN (USA). [1989]. 10p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 17. water reactor safety information meeting; Rockville, MD (USA); 23-25 Oct 1989. Order Number DE90001975. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Regulatory and research evaluations of embrittlement prediction models and of vessel integrity under load can be greatly expedited by the use of a well-designed, computerized embrittlement data base. The Power Reactor Embrittlement Data Base (PR-EDB) is a comprehensive collection of data from surveillance reports and other published reports of commercial nuclear reactors. The uses of the data base require that as many different data as available are collected from as many sources as possible with complete references and that subsets of relevant data can be easily retrieved and processed. The objectives of this NRC-sponsored program are the following: to compile and to verify the quality of the PR-EDB; to provide user-friendly software to access and process the data; to explore or confirm embrittlement prediction models; and to interact with standards organizations to provide the technical bases for voluntary consensus standards that can be used in regulatory guides, standard review plans, and codes. 9 figs.

2511 (CONF-8910222–4) **Aging assessment of auxiliary feedwater systems.** Casada, D.A. Oak Ridge National Lab., TN (USA). 1989. 14p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 17. water reactor safety information meeting; Rockville, MD (USA); 23-25 Oct 1989. Order Number DE90002478. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A study of Pressurized Water Reactor Auxiliary Feedwater (AFW) Systems has been conducted by Oak Ridge National Laboratory (ORNL) under the auspices of the Nuclear Regulatory Commission's Nuclear Plant Aging Research Program. The study has reviewed historical failure experience and current monitoring practices for the AFW System. This paper provides an overview of the study approach and results. 7 figs.

2512 (CONF-8910239–5) **The development and revision of the Federal Radiological Emergency Response Plan.** Gant, K.S.; Adler, M.V.; Wolff, W.F. Oak Ridge National Lab., TN (USA). [1989]. 9p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. From 13. annual TRADE conference; Baltimore, MD (USA); 22-25 Oct 1989. Order Number DE90002711. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Since 1985, federal agencies have been using the Federal Radiological Emergency Response Plan (FRERP) in exercises and real events. This experience and the development of other emergency response guidance (e.g., National System for Emergency Coordination) are fueling current efforts to review and revise the FRERP to reflect what the agencies have learned since the FRERP was published. Revision efforts are concentrating on clarifying the plan and addressing deficiencies. No major changes are expected in the general structure of the federal response nor should states need to revise their plans because of these modifications. 5 refs.

2513 (CONF-8910274–1) **Embrittlement of cast stainless steels in LWR systems.** Chopra, O.K.; Chung, H.M. Argonne National Lab., IL (USA). Aug 1989. 34p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. From 15. MPA seminar on safety and reliability of plant technology; Stuttgart (Germany, F.R.); 5-6 Oct 1989. Order Number DE90001928. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Mechanical property data from Charpy-impact and J-R curve tests are presented for several experimental and commercial heats, as well as reactor-aged material of CF-3, CF-8, and CF-8M grades of cast stainless steel. The effects of material variables on the embrittlement of cast stainless steels are evaluated. The chemical composition and ferrite morphology have a strong effect on the extent and kinetics of embrittlement. The data are analyzed to establish the mechanisms of embrittlement. The procedure and correlations for predicting the impact strength and fracture toughness of cast components during reactor service are described. The lower bound values of impact strength and fracture toughness for low-temperature aged cast stainless steel are defined. 13 refs., 13 figs., 3 tabs.

2514 (DOE/EH–0101) **Technical Safety Appraisal of the Fast Flux Test Facility, Westinghouse Hanford Company.** US-DOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Oct 1989. 82p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90001892. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report presents the findings and concerns from the second Technical Safety Appraisal of the Fast Flux Test Facility. The appraisal was conducted during site visits of August 7–11 and August 21–30, 1989. The first Technical Safety Appraisal was conducted in February–March 1986. The Fast Flux Test Facility is located on the US Department of Energy Hanford Site near Richland, Washington, and is operated by the Westinghouse Hanford Company. This facility was designed specifically for irradiation testing of nuclear reactor fuels and materials for liquid-metal-fast-breeder reactors. The term Fast Flux Test Facility includes the reactor as well as the equipment and structures for heat removal, containment, core component handling and examination, instrumentation and control, and for supplying utilities and services such as emergency power generation and irradiated fuel storage.

2515 (DOE/ID–10216-Vol.6) **DOE modifications to the MAAP [Modular Accident Analysis Program] code: Volume 6, Core melt progression modeling and benchmarking WBS 3.4.8.** Plys, M.G.; Wu, Chun-Der; Epstein, M.; Hammersley, R.J. EG and G Idaho, Inc., Idaho Falls, ID (USA); Fauske and Associates, Inc., Burr Ridge, IL (USA). Aug 1989. 115p. Sponsored by U.S. DOE

Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE90002006. Available from NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

This report presents an enhanced model for the MAAP code that addresses fuel-cladding interaction and core mass relocation during core degradation. The main purpose of this work is to assess the potential for in-vessel hydrogen production and to reduce the uncertainty in fission product source term evaluation. The model provides a description of fuel behavior in which the fuel comprises uranium dioxide, zirconium dioxide, and U-Zr-O compounds. The composition of the U-Zr-O compounds and their solidus and liquidus temperatures are calculated throughout the core melt transient. The interaction of control rod materials with fuel and cladding and the relocation of control rod materials are not addressed in this enhanced model. The enhanced core melt progression model has been applied to a hypothetical station blackout accident with a small break via the reactor coolant pump seals. The new model has been benchmarked against both the LOFT experiment LP-FP-2 and the TMI-2 accident prior to the B-loop pump restart. Although some uncertainties and deviations were seen, general agreement was obtained with the experimental data and with the TMI-2 accident. 21 refs., 30 figs.

2516 (EGG-EAST–8546) **Course A—Numerical modeling of two-phase flows for presentation at Ecole d'Ete d'Analyse Numerique.** Ransom, V.H. EG and G Idaho, Inc., Idaho Falls, ID (USA). May 1989. 376p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8906249–1: Summer school on numerical analysis, Saclay (France), 12-23 Jun 1989). Order Number DE90002074. Available from NTIS, PC A17/MF A01; OSTI; INIS; GPO Dep.

This course is designed to provide an introduction to the application of two-fluid modeling techniques to two-phase or, more generally, multiphase flows, and to the numerical methods that have been developed for solution of such problems. The methods that are presented have evolved to a large extent as a result of international efforts to improve the understanding of light-water-reactor transient response to postulated loss of coolant accidents. Transient simulation codes that are based on these methods are now in routine use throughout the international light-water-reactor safety research and regulatory organizations. 159 refs., 54 figs., 8 tabs.

2517 (EGG-M–32787) **Modeling of thermal hydraulic behavior and fission product releases in degraded cores.** Sharon, A.; Ellison, P.G.; Henry, R.E.; Kenton, M.A.; Hammersley, R.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-880309–8: International symposium on severe accidents in nuclear power plants IAEA - OECD/NEA, Sorrento (Italy), 21-25 Mar 1988; IAEA-SM–296/80). Order Number DE90001999. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

When core material reaches melting conditions severe degradation of the core geometry occurs. Data available on the core behavior in a severely degraded state suggest that extensive blockage of the flow channels would occur. If a sufficient bypass is available for the gas flow, such as in the LOFT LP-FP-2 test, severe retardation of the hydrogen and fission product sources from the degraded channel is suggested from the available data. This phenomena is expected to occur in an LWR core and should be considered by core models that are used for severe accident analysis. In the MAAP code it is done by preventing gas flow through molten core regions. Good agreement is obtained with all relevant data that are directly applicable to LWR accident conditions. A more mechanistic model for the freezing of core material and its effect on the coolant channel geometry is currently being investigated by the US Department of Energy Advanced Reactor Severe Accident Program (ARSAP). 8 refs., 2 figs.

2518 (EGG-M–36787) **Scale model test results for an inverted U-tube steam generator with comparisons to heat transfer correlations.** Boucher, T.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1987]. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-871234–16: ASME winter meeting, Boston, MA (USA), 13-18 Dec 1987). Order Number DE90002003. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

To provide data for assessment and development of thermal-hydraulic computer codes, bottom main feedwater-line-break transient simulations were performed in a scale model (Semiscale Mod-2C) of a pressurized water reactor (PWR) with conditions typical of a PWR (15.0 MPa primary pressure, 600 K steam generator inlet plenum fluid temperatures, 6.2 MPa secondary pressure). The state-of-the-art measurements in the scale model (Type III) steam generator allow for the determination of U-tube steam generator allow for the determination of U-tube steam generator secondary component interactions, tube bundle local radial heat transfer, and tube bundle and riser vapor void fractions for steady state and transient operations. To enhance the understanding of the observed phenomena, the component interactions, local heat fluxes, local secondary convective heat transfer coefficients and local vapor void fractions are discussed for steady state, full-power and transient operations. Comparisons between the measurement-derived secondary convective heat transfer coefficients and those predicted by a number of correlations, including the Chen correlation currently used in thermal-hydraulic computer codes, show that none of the correlations adequately predict the data and points out the need for the formulation of a new correlation based on this experimental data. The unique information presented herein should be of the interest to anyone involved in modeling inverted U-tube steam generator thermal-hydraulics for forced convection boiling/vaporization heat transfer. 5 refs., 13 figs., 1 tab.

2519 (EGG-M–88156) **Just how much water is required to cool a molten core?.** Langer, S. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881024–17: TMI-2 accident materials behavior, plant technology and recovery, Washington, DC (USA), 30 Oct - 4 nov 1988). Order Number DE90001995. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The tacit assumption in early severe accident studies was that the melting of a reactor core would result in failure of the reactor pressure vessel and eventually failure of the containment building and release of fission products to the environment. This assumption was shown to be wrong by the TMI-2 accident in which 50% of the core melted, yet fission product release to the environment was insignificant. Survival of the reactor vessel is attributed to the presence of water in the vessel. The quantity of water required to cool the molten core and reestablish stable core cooling is calculated and the implications of these results for future accident management are discussed. 12 refs.

2520 (EGG-M–88163) **TMI-2 data qualification and data bases.** Golden, D.W.; Anderson, J.L.; Brower, R.W.; Fackrell, L.J.; McCormick, R.D. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 30p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881024–18: TMI-2 accident materials behavior, plant technology and recovery, Washington, DC (USA), 30 Oct - 4 nov 1988). Order Number DE90002044. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

TMI-2 data are of great interest to the scientific community, since the March, 1979 accident represents the only occurrence of a transient resulting in severe fuel damage in a full-scale commercial production reactor. This paper discusses the data sources available for accident analyses. Techniques to qualify and quantify time series measurement and sample data which have been collected and evaluated to this time are discussed. Data base products are described which have been developed for use by analysts investigating the many aspects of the accident. Applications processing features have been incorporated into the software designs to provide the end user with many useful capabilities in sorting, viewing and analyzing the data; data base discussions emphasize these features. 14 refs., 5 figs.

2521 (EGG-M–88275) **Development of an aging evaluation and life extension program for the Advanced Test Reactor.** Dwight, J.E. Jr. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-880748–13: American Nuclear Society topical meeting on nuclear power plant life extension, Snowbird, UT (USA), 31 Jul - 3 aug 1988). Order Number DE90002013. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A life extension program has been developed for the US Department of Energy's Advanced Test Reactor. The program is an adaptation of life extension pilot programs at the Surry Unit 1 and Monticello generating stations and is being completed in three phases. In Phase 1, the critical plant components were identified. In Phase 2, existing lifetime analyses and support data for the critical components were reviewed. The results from the review give a preliminary indication that an overall plant lifetime in excess of forty years is feasible. In Phase 3, now in progress, detailed evaluations for component life extensions are being performed. 2 refs., 2 figs., 1 tab.

2522 (EGG-M–88300) **Aging evaluation of electrical circuits using the ECCAD [Electrical Circuit Characterization and Diagnostics] system.** Edson, J.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 8p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-880824–5: International nuclear power plant aging symposium, Bethesda, MD (USA), 30 Aug - 1 sep 1988). Order Number DE90002075. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

As a part of the Nuclear Regulatory Commission Nuclear Plant Aging Research Program, an aging assessment of electrical circuits was conducted at the Shippingport Atomic Power Station Decommissioning Project. The objective of this work was to evaluate the effectiveness of the Electrical Circuit Characterization and Diagnostic (ECCAD) system in identifying circuit conditions, to determine the present condition of selected electrical circuits, and correlate the results with aging effects. To accomplish this task, a series of electrical tests was performed on each circuit using the ECCAD system, which is composed of commercially available electronic test equipment under computer control. Test results indicate that the ECCAD system is effective in detecting and identifying aging and service wear in selected electrical circuits. The major area of degradation in the circuits tested was at the termination/connection points, whereas the cables were in generally good condition. 1 ref., 8 figs., 1 tab.

2523 (EGG-M–88428) **Quality Assurance in the removal and transport of the TMI-2 core.** Hayes, G.R.; Marsden, J.F. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 24p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881011–41: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988). Order Number DE90002031. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

EG&G Idaho, acting on behalf of the US Department of Energy (DOE), is cooperating with the owner of the TMI-2 plant, General Public Utilities Nuclear (GPUN), in the removal and transport of the damaged TMI-2 core to the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho. Quality Assurance (QA) played an important role in the removal and transport of the damaged TMI-2 core. To illustrate, the authors have chosen to discuss some of the important quality assurance techniques utilized in the design, fabrication, acceptance, and use of the three different types of equipment; the core boring machine, the core debris canisters, and the transport casks. Rather than a thorough discussion of the QA aspects of each task, the authors have purposely chosen to present only the key applications of quality assurance principles and methodology unique to each piece of equipment. The intent of this approach is to effectively communicate the importance of "task teamwork" in QA.

2524 (EGG-M–88438) **Comparison of thermal and mechanical responses of the TMI-2 reactor vessel.** Thinnes, G.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 31p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881011–42: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988). Order Number DE90002032. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The TMI-2 accident resulted in approximately 40% of the reactor's core melting and collecting on the lower head of the reactor pressure vessel. The severity of the accident has raised questions about the margin of safety against rupture of the lower head in this accident since all evidence seems to indicate no major breach of the vessel occurred. Scoping heat transfer analyses of the relocated core debris and lower head have been made based upon assumed core melting scenarios and core material debris formations while in contact with the lower head. 7 refs., 16 figs.

2525 (EPRI-NP–4574-CCM-Pt.2-Ch.5-Vol.1) **ARMP-02 documentation: Part 2, Chapter 5, EPRI-PRESS computer code manuals: Volume 1, Theory and numerics.** Mosteller, R.D. Electric Power Research Inst., Palo Alto, CA (USA); Levy (S.), Inc., Campbell, CA (USA). c Oct 1989. 244p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

EPRI-PRESS is a computer program that automates the ARMP PWR calculational path. The CELL-2, NUPUNCHER-2, APLB, GAD, and PDQ7-E modules, which previously functioned as stand-alone codes, are combined into a single application which generates cross sections and other data for eventual use in the nodal programs SIMULATE-E and NODE-P2. In addition, the cross sections so generated can be input to stand-alone PDQ7-E calculations. Based on internal procedures, the CELL-2 module generates cross sections and other data for normal fuel pins, non-fuel regions, lumped burnable poison rods, and gadolinia-loaded fuel pins. "Generic" control-rod cross sections for a variety of PWR assembly designs are stored internally and can be used if the user so chooses. The NUPUNCHER-2, APLB, and GAD modules process the data from CELL-2 into input for the PDQ7-E module, performing transport-to-diffusion parameterizations where necessary. EPRI-PRESS contains case lists for so-called "one-temperature" and "three-temperature" models, and it will execute cases for whichever one of these models the user specifies. EPRI-PRESS builds input, executes all the specified cases, manages all data files, and produces a binary integral file which can be processed by the NORGE-P linkage code into input for either SIMULATE-E or NODE-P2. By doing so, it dramatically reduces the amount of effort and time required to perform these functions. It also simplifies traceability through the reduction of input and the use of automated data management. 89 refs., 16 figs., 23 tabs.

2526 (EPRI-NP–6496) **Lower-bound magnitude for probabilistic seismic hazard assessment: Final report.** McCann, M.W. Jr.; Reed, J.W. Electric Power Research Inst., Palo Alto, CA (USA); Benjamin (J.R.) and Associates, Inc., Mountain View, CA (USA). c Oct 1989. 378p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report provides technical information to determine the lower-bound earthquake magnitude (LBM) for use in probabilistic seismic hazard (PSH) computations that are applied to nuclear plant applications. The evaluations consider the seismologic characteristics of earthquake experience at similar facilities and insights from probabilistic risk analysis. The recommendations for LBM satisfy the two basic precepts: (1) there is a reasonable engineering assurance that the likelihood of damage due to earthquakes smaller than the LBM is negligible, and (2) any small risk due to earthquakes smaller than the LBM is compensated by conservatisms in PSH results for larger earthquakes. Theoretical and empirical ground motion studies demonstrate that ground shaking duration and spectral shape are a strong function of earthquake magnitude. Small earthquakes have short duration and spectral shapes centered at high frequencies as compared to nuclear power plant design spectra which are typical of moderate and large earthquakes. Analysis of earthquake experience data shows damage to heavy industrial facilities, taken as analogs to nuclear plant structures and components, occurs for earthquakes having moment magnitude M larger than 5.1. Probabilistic seismic risk and margins studies show nuclear plant structures and adequately anchored ductile components to be rugged for moderate-size earthquakes with broad design-type spectral shapes. They may, therefore, be considered rugged for small earthquakes. Finally, nonlinear analysis of the damage effectiveness of strong-motion recordings shows that potential damage does not occur for earthquakes smaller than about M5.6. These results support a conservative LBM of M5.0 for application to nuclear power plant PSH assessments. 144 refs., 78 figs., 34 tabs.

2527 (HW–34461) **Preliminary report, KW reactor incident.** McEwen, L.H. Hanford Works, Richland, WA (USA). 17 Jan 1955.

17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90002520. Available from NTIS, PC A03/MF A01 - OSTI.

Declassified 20 Jul 1988.

This is a brief report of the KW reactor incident of January 5, 1955. While the report is based on preliminary data, it is believed to be substantially correct concerning the significant aspects of the incident. More detailed studies now under way will no doubt provide some additional and pertinent details. The report is annotated. The notes pertain to certain aspects of the incident not critical for an understanding of the incident itself and also explain some details of reactor construction, equipment, and practices not of general knowledge. 5 figs.

2528 (IAEA-SM–310/63P) **A preliminary modeling and analysis framework for severe accident analysis of high power density research reactors.** Greene, S.R.; Simpson, D.B.; Taleyarkhan, R.P. International Atomic Energy Agency, Vienna (Austria). [1989]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. (CONF-891027–6: International symposium on research reactor safety, operations and modifications, Chalk River (Canada), 23-27 Oct 1989). Order Number DE90002483. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent studies of research and production reactor safety are prompting the need for extended severe accident analysis capabilities for those facilities. High power density research reactors have unique design and safety features, and a program to address severe accident issues in such reactors was recently initiated at the Oak Ridge National Laboratory (ORNL). The phased approach and methodology proposed to address severe accident issues in high power density research reactors are presented, along with some emerging insights from ORNL's severe accident studies for the 85 MWt High Flux Isotope Reactor (HFIR) and the planned 332 MWt Advanced Neutron Source (ANS). The goal of these efforts is to provide a more detailed and credible simulation of severe accident issues for research reactors, such as core melting and relocation, fuel-coolant interactions, and core-concrete interactions, than is possible via application of the current generation of light water reactor (LWR) severe accident analysis codes. 3 refs., 2 tabs.

2529 (INIS-BR–1733) **Environmental protection and safety of nuclear facilities.** Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1977. 149p. (In Portuguese). Order Number DE90608315. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Some papers about environmental effects, safety analysis and radioactive waste management of nuclear power plants are presented.

2530 (INIS-mf–12016) **Critical investigations and model development on countercurrent flow of gas and liquid in horizontal and vertical channels. Final report.** Mewes, D.; Beckmann, H. Hannover Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1989. 50p. (In German). Contract BMFT 1 500 719. Order Number DE90722260. Available from NTIS (US Sales Only), PC A03/MF A01.

Countercurrent flow of steam and water occurs in the horizontal and vertical lines of a PWR in case of a LOCA. In order to predict the emergency core cooling behaviour in case of a large or small break LOCA it is important to calculate the volumetric flow rate of water which will get to the reactor core. Theoretical and experimental results of countercurrent flow in horizontal and vertical channels given by publication and reports are critically reviewed for the purpose of a more physical understanding of the flow phenomena. The influence of geometry, pressure and other boundary conditions are emphasized. The existing models which are developed to calculate the onset of flooding are based on experimental results of small test facilities. The applicability of these models to large geometries and high pressures as well as the consideration of condensation and entrainment are investigated. (orig./HP).

2531 (INIS-mf–12017) **Elastic-plastic fracture mechanics analysis of a pressure vessel with an axial outer surface flaw. Technical report.** Aurich, D. Bundesanstalt fuer Materialforschung und -pruefung, Berlin (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Apr 1989. 59p. (In German). Contract BMFT 1500 490. Order Number DE90722261. Available from NTIS (US Sales Only), PC A04/MF A01.

Elastic-plastic finite element analyses of a test vessel (steel 1.6310=20 MnMoNi 55) with a semi-elliptical axial outer surface crack have been performed. The variations of J and CTOD along the crack front and the stresse state in the vicinity of the crack are presented. The applicability of approaches to determine J is examined. The FE results are compared with the experimental data. The results are analyzed with respect to the validity of J-controlled crack growth. It will be shown that the local ductile crack growth and, especially, the 'canoe effect' for a semi-elliptical crack can only be described correctly if local J_R-curves are used which account for the varying triaxiality of the stress state along the crack front. (orig./HP).

2532 (INIS-mf–12019) **Development of a technique for dismantling geometric complicated and thick components of closed down nuclear power plants with the principle of arc-waterjet cutting. Final report.** Bach, F.W.; Bruening, D. Hannover Univ. (Germany, F.R.). Inst. fuer Werkstoffkunde; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Apr 1989. 92p. (In German). Contract BMFT 02 S 7185. Order Number DE90722431. Available from NTIS (US Sales Only), PC A05/MF A01.

1. Status of research: With arc waterjet cutting it is possible to cut stainless steel up to a wall thickness of 30 mm under water. An application of this technique in 20 m water depth is possible. 2. Aim of research work: A thermal cutting process which is empolyed in a water depth of 20 m is to be developed. Stainless steel up to a wall thickness of 100 mm must be sectile. Cutting of plane parts with variable wall thickness and geometric must be possible. Pipes and pipe assemblies are to be cut from inside or outside. 3. Method of research: A torch was developed which can melt the work piece with a wire electrode. The ignition of cutting will be done with short circuit with a concentrial around the wire out going water jet the liquid metal will be washed away. 4. Results: It is possible to cut stainless steel under water up to a wall thickness of 100 mm. There is no influence to the cutting process in a water depth of 20 m. 5. Suitability: With arc waterjet cutting remote controlled dismantling of thick-walled components of closed down nuclear power plants under water is possible. (orig.) With 35 refs., 6 tabs., 65 figs.

2533 (JAERI-M–89-076) **Study on the behavior of PWR remedy fuel under reactivity initiated accident conditions. Effect of pellet shape modification.** Yanagisawa, Kazuaki. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 18p. (In Japanese). Order Number DE90719547. Available from NTIS (US Sales Only), PC A03/MF A01.

An influence of pellet shape modification on the failure thresholds of domestic PWR fuel rods under the reactivity initiated accident (RIA) conditions was studied. Experimental parameters used were pellet end shape and its length (L) to diameter (D) ratio. Comparisons were made between fuels with double dishing with a large L/D = 1.65 (standard fuels) and fuels with double dishing and chamfering with a small L/D = 1.22 (remedy fuels). After prepressurization to the ranges from 3.0 to 3.5 MPa, the two were pulse irradiated at NSRR. Major results obtained are: (1) Within this experimental scope, no differences in failure thresholds were existed between the standard fuels and the remedy fuels. The failure thresholds of these fuels were about 150 cal/g fuel (0.63 kJ/g fuel). On the other hand, the failure threshold of past NSRR prepressurized standard fuels shown in the RIA Safety Guide Standard was about 120 cal/g fuel (0.50 kJ/g fuel). Consequently, the tested rods have shown the enough safety margins. (2) The failure mechanisms were cladding rupture induced by ballooning. The mechanisms were the same as observed preveously in the past NSRR experiments with prepressurized standard fuels. (author).

2534 (JAERI-M–89-077) **Review on fission product source term from fuel at severe accident conditions, chemical forms and release rates.** Nakamura, Takehiko; Yanagihara, Satoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 67p. (In Japanese). Order Number DE90719540. Available from NTIS (US Sales Only), PC A04/MF A01.

Fission product source terms at severe accident conditions have been studied vigorously since the accident at TMI unit 2. Among with the effort, some series of out-of-pile experiments have been performed to investigate fission product release behavior, exclusively, from fuel rods at the off-normal conditions. This report reviews the results of two major series of the source term tests, i.e. SASCHA (PNS Project, FRG) and HI-VI test (ORNL, USA). These tests have been the major sources for estimating fission product source terms in the primary cooling system, in the containment and subsequently to the environment at hypothetical Severe Accidents. Findings on the chemical forms of some important fission products in these tests are summarized. A diffusion model is introduced to represent volatile fission product release observed in the ORNL tests. The diffusion model described Kr and Cs releases better than the existing CORSON-M model does. In addition, experimental and analytical techniques used in these tests are also summarized, in order to clarify the reliability and problems of the test data. (author).

2535 (JAERI-M–89-078) **Study on the behavior of waterside corroded PWR fuel rods under reactivity initiated accident conditions.** Sasajima, Hideo. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 41p. (In Japanese). Order Number DE90719542. Available from NTIS (US Sales Only), PC A03/MF A01.

One of the highlighted problems from the fuel reliability point of view is a waterside corrosion of fuel cladding which becomes more significant at extended burnup stages. To date, at highly burned fuel, waterside corrosion was recognized as important because cladding oxidation increased with increasing burn-up. In experiments, as the basic research for the study of high burn-up fuel, the test fuel rods were prepressurized to ranges from 3.47 to 3.55 MPa, oxidized artificially to both 10 and 20 μm in thickness. Regarding fabricated oxide thickness of 10 μm, it is corresponded to be transition point from cubic law to linear law as a function of burn-up. Pulse irradiation experiments by NSRR were carried out to study the behavior of waterside corroded PWR type fuels under RIA conditions. Obtained results are: (1) The failure threshold of tested fuels was 110 cal/gcenter dotfuel (0.46 KJ/gcenter dotfuel) in enthalpy. This showed that the failure threshold of tested fuels was same as that of the past NSRR experimental data. (2) The failure mechanisms of the tested fuel rods was cladding rupture induced by ballooning. No differences in failure mechanisms existed between the past NSRR prepressurized standard fuel and the tested fuels. (3) Cracks were existed without propagating into cladding matrix, so that it was judged that these were not initiation of failure. (4) Whithin this experimental condition, reduction of cladding thickness being attributed to the increase of oxidation did not failure threshold. (author).

2536 (NUREG–1232-Vol.3-Suppl.1) **Safety evaluation report on Tennessee Valley Authority: Browns Ferry nuclear performance plan: Browns Ferry Unit 2 restart: Volume 3, Supplement 1.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Oct 1989. 96p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

This safety evaluation report (SER) on the information submitted by the Tennessee Valley Authority (TVA) in its Nuclear Performance Plan, through Revision 2, for the Browns Ferry Nuclear Plant and in supporting documents has been prepared by the US Nuclear Regulatory commission staff. The Browns Ferry Nuclear Plant consists of three boiling-water reactors at a site in Limestone County, Alabama. The plan addresses the plant-specific concerns requiring resolution before the startup of Unit 2. The staff will inspect implementation of those TVA programs that address these concerns. Where systems are common to Units 1 and 2 or to Units 2 and 3, the staff safety evaluations of those systems are included herein. 85 refs.

2537 (NUREG–1384-Vol.1) **Human Factors Regulatory Research Program Plan, FY 1989–FY 1992: Volume 1.** Coffman, F.; Persensky, J.; Ryan, T.; Ramey-Smith, A.; Goodman, C.; Serig, D.; Trager, E. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research. Oct 1989. 73p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

This report describes the currently ongoing (FY 1989) and planned (FY 1989-1992) Human Factors Regulatory Research Program in the NRC Office of Nuclear Regulatory Research (RES). Examples of the influence of human factors on nuclear safety are presented, and the role of personnel is discussed. Current regulatory issues associated with human factors in the nuclear system and the purpose of the research plan are provided. The report describes the research process applied to the human factors research issues and the program activities: Personnel Performance Measurement, Personnel Subsystem, Human-System Interface. Organization and Management, and Reliability Assessment. The research being conducted within each activity is summarized along with the objectives, background information, and expected regulatory products. Budget and personnel forecasts are provided along with a summary of contractors performing some of the ongoing research. Appendices contain a chronology of human factors research at NRC, a description of the research approach, an update on human factors programs and initiatives in RES and other NRC offices, and the integration among these programs. 46 refs., 5 tabs.

2538 (NUREG/CP–0102-Vol.1) **NRC regulatory information conference: Proceedings: Volume 1.** Nuclear Regulatory Commission, Washington, DC (USA). Sep 1989. 546p. Sponsored by Nuclear Regulatory Commission. (CONF-8904274–Vol.1: NRC regulatory information conference, Washington, DC (USA), 18-20 Apr 1989). Available from NTIS, PC A23/MF A01 - GPO; OSTI; INIS.

This volume of the report provides the proceedings from the Nuclear Regulatory Commission (NRC) Regulatory Information Conference that was held at the Mayflower Hotel, Washington, DC, on April 18, 19, and 20, 1989. This conference was held by the NRC and chaired by Dr. Thomas E. Mosley, Director, Office of Nuclear Reactor Regulations (NRR) and coordinated by S. Singh Bajwa, Chief, Technical Assistance Management Section, NRR. There were approximately 550 participants from nine countries at the conference. The countries represented were Canada, England, Italy, Japan, Mexico, Spain, Taiwan, Yugoslavia, and the United States. The NRC staff discussed with nuclear industry its regulatory philosophy and approach and the bases on which they have been established. Furthermore, the NRC staff discussed several initiatives that have been implemented recently and their bases as well as NRC's expectations for new initiatives to further improve safety. The figures contained in Appendix A to the volume correspond to the slides that were shown during the presentations. Volume 2 of this report contains the formal papers that were distributed at the beginning of the Regulatory Information Conference and other information about the conference.

2539 (NUREG/CR–2850-Vol.8) **Population dose commitments due to radioactive releases from nuclear power plant sites in 1986.** Baker, D.A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Computer and Telecommunications Services; Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 163p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (PNL–4221-Vol.8). Available from NTIS, PC A08/MF A01 - GPO; OSTI; INIS.

Population radiation dose commitments have been estimated from reported radionuclide releases from commercial power reactors operating during 1986. Fifty-year dose commitments for a one-year exposure from both liquid and atmospheric releases were calculated for four population groups (infant, child, teen-ager and adult) residing between 2 and 80 km from each of 66 reactor sites. This report tabulates the results of these calculations, showing the dose commitments for both water and airborne pathways for each age group and organ. Also included for each of the sites is a histogram showing the fraction of the total population within 2 to 80 km around each site receiving various average dose commitments from the airborne pathways. The total dose commitments (from both liquid and airborne pathways) for each site ranged from a high of 31 person-rem to a low of 0.0007 person-rem for the sites with plants operating throughout the year with an arithmetic mean of 1.7 person-rem. The total population dose for all sites was estimated at 110 person-rem for the 140 million people considered at risk. The site average individual dose commitment from all pathways ranged from a low of 2×10^{-6} mrem to a high of 0.02 mrem. No attempt

was made in this study to determine the maximum dose commitment received by any one individual from the radionuclides released at any of the sites. 12 refs.

2540 (NUREG/CR–2907-Vol.8) **Radioactive materials released from nuclear power plants: Annual report, 1987.** Tichler, J.; Norden, K.; Congemi, J. Nuclear Regulatory Commission, Washington, DC (USA). Office of Information Resources Management; Brookhaven National Lab., Upton, NY (USA). Oct 1989. 327p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–51581-Vol.8). Available from NTIS, PC A15/MF A01 - GPO; OSTI; INIS.

Releases of radioactive materials in airborne and liquid effluents from commercial light water reactors during 1987 have been compiled and reported. Data on solid waste shipments as well as selected operating information have been included. This report supplements earlier annual reports issued by the former Atomic Energy Commission and the Nuclear Regulatory Commission. The 1987 release data are summarized in tabular form. Data covering specific radionuclides are summarized. 16 tabs.

2541 (NUREG/CR–5215) **A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation.** Wong, C.C. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 102p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–88-2260). Available from NTIS, PC A06/MF A01 - GPO - OSTI.

To assist in the resolution of differences between the NRC and IDCOR on the hydrogen combustion issue, a standard problem has been defined to compare the results of HECTR and MAAP analyses of hydrogen transport and combustion in a nuclear reactor containment. The first part of this problem, which addresses the question of deflagration in the upper and lower compartments, was presented in NUREG/CR-4993. The second part of this problem has been completed and is discussed in this report. This part addresses the issue of in-cavity oxidation of combustible gases produced by core-concrete interactions and the natural circulation between the reactor cavity and the lower compartment. HECTR analyses of the problem show that it is overly optimistic to assume a complete oxidation in the reactor cavity because a variety of phenomena, such as steam inerting and oxygen transport by natural convection, may influence the degree of in-cavity oxidation that takes place. An incomplete in-cavity oxidation will lead to accumulation and combustion of hydrogen and carbon monoxide in the lower and upper compartments in the reactor containment. This deflagration generates a peak pressure of 384.2 kPa (55.72 psia) at 7.36 hours. 20 refs., 38 figs., 2 tabs.

2542 (NUREG/CR–5225) **An overview of BWR Mark-I containment venting risk implications.** Wagner, K.C.; Dallman, R.J.; Galyean, W.J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (USA). Nov 1988. 81p. DOE Contract AC07-76ID01570. (EGG–2548). Available from Q;I 05/MF A01 - OSTI.

Venting of boiling water reactors with Mark-I containments has been suggested as a way to prevent catastrophic failure and/or mitigate the consequences resulting from a severe accident. Based on phenomenological, human factors, and risk considerations, the potential benefits and downsides of venting Mark-I containments were analyzed. Several generic venting systems and two proposed utility systems were reviewed. Based on generic considerations, the offsite consequences during risk dominant accidents were qualitatively assessed for four different vent systems. A quantitative risk study of an early venting strategy was performed, based on the existing Peach Bottom hardware and the draft NUREG-1150 results for Peach Bottom. Appendices are also included which contain reviews of the Pilgrim and Vermont Yankee venting submitals, a response to the seven questions from the NRC about the Pilgrim venting strategy, and a review of the venting strategy directed by Revision 4 of the Boiling Water Reactor Emergency Procedures Guidelines. 16 refs., 7 figs., 7 tabs.

2543 (NUREG/CR–5236) **Radiation-related impacts for nuclear plant physical modifications: Final report.** Sciacca, F.; Knudson, R.; Simion, G.; Baca, G.; Behling, H.; Behling, K.; Britz, W.; Cohen, S. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Science and Engineering Associates, Inc., Albuquerque, NM (USA); Cohen (S.) and Associates, Inc., McLean, VA (USA). Oct 1989. 55p. Sponsored by Nuclear Regulatory Commission. (SEA–87-253-08-A:1). Available from NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

The radiation fields in nuclear power plants present significant obstacles to accomplishing repairs and modifications to many systems and components in these plants. The NRC's generic cost estimating methodology attempts to account for radiation-related impacts by assigning values to the radiation labor productivity factor. This radiation labor productivity factor is then used as a multiplier on the greenfield or new nuclear plant construction labor to adjust for the actual operating plant conditions. The value assigned to the productivity factor is based on the work-site radiation levels. The relationship among ALARA practices, work-place radiation levels, and radiation-related cost impacts previously had not been adequately characterized or verified. The assumptions made concerning the use and application of radiation-reduction measures such as system decontamination and/or the use of temporary shielding can significantly impact estimates of both labor requirements and radiation exposure associated with a particular activity. Overall guidance was needed for analysts as to typical ALARA practices at nuclear power plants and the effects of these practices in reducing work-site dose rates and overall labor requirements. This effort was undertaken to better characterize the physical modification cost and radiological exposure impacts related to the radiation environment of the work place. More specifically, this work sought to define and clarify the quantitative relationships between or among: radiation levels and ALARA practices, such as the use of temporary shielding, decontamination efforts, or the use of robots and remote tools; radiation levels and labor productivity factors; radiation levels, in-field labor hours, and worker radiation exposure; radiation levels and health physics services costs; and radiation levels, labor hours, and anti-contamination clothing and equipment. 48 refs., 4 figs., 4 tabs.

2544 (NUREG/CR–5293) **Closeout of IE Bulletin 86-01: Minimum flow logic problems that could disable residual heat removal pumps: Minimum flow logic problems that could disable residual heat removal pumps.** Foley, W.J.; Dean, R.S.; Hennick, A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Events Assessment; Parameter, Inc., Elm Grove, WI (USA). Mar 1989. 27p. Available from NTIS, PC A03/MF A01 - GPO - OSTI.

Documentation is provided in this report for the closeout of IE Bulletin 86-01 regarding minimum flow logic problems that could disable residual heat removal (RHR) pumps in General Electric boiling water reactor facilities (GE/BWRs). Closeout is based on the implementation and verification of four (4) required actions by holders of operating licenses and construction permits of GE/BWR power reactors. Evaluation of responses and NRC/Region inspection reports indicates that the bulletin is closed for all of the 39 affected facilities. Background information is supplied in the Introduction and Appendix A of this report.

2545 (NUREG/CR–5294) **Closeout of IE Bulletin 86-02: Static "O" ring differential pressure switches.** Foley, W.J.; Dean, R.S.; Hennick, A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Assessment; Parameter, Inc., Elm Grove, WI (USA). Oct 1989. 36p. Sponsored by Nuclear Regulatory Commission. (PARAMETER/IE–185). Available from NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

Documentation is provided in this report for the closeout of IE Bulletin 86-02 regarding static "O" ring differential pressure switches Series 102 or 103 supplied by SOR, Incorporated, as electrical equipment important to safety. Closeout is based on the implementation and verification of either one or six actions required by the bulletin for holders of an operating license or a construction permit for a nuclear power plant. All six actions are required when the facility is equipped with the switches of concern in systems subject to limiting conditions for operations in technical specifications. Evaluation of utility responses and NRC/Region inspection reports in

accordance with two criteria indicates that the bulletin is closed for 116 (97%) of the 119 nuclear power facilities to which it was issued for action. Followup items are proposed for the three (3) facilities with open status, for the use of NRC regional inspectors in ensuring successful completion of required and corrective actions. A conclusion based on the utility responses is presented.

2546 (NUREG/CR–5364) **Summary of advanced LMR [Liquid Metal Reactor] evaluations: PRISM [Power Reactor Inherently Safe Module] and SAFR [Sodium Advanced Fast Reactor].** Van Tuyle, G.J.; Slovik, G.C.; Chan, B.C.; Kennett, R.J.; Cheng, H.S.; Kroeger, P.G. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (USA). Oct 1989. 120p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–52197). Available from NTIS, PC A07/MF A01 - GPO; OSTI; INIS.

In support of the US Nuclear Regulatory Commission (NRC), Brookhaven National Laboratory (BNL) has performed independent analyses of two advanced Liquid Metal Reactor (LMR) concepts. The designs, sponsored by the US Department of Energy (DOE), the Power Reactor Inherently Safe Module (PRISM) [Berglund, 1987] and the Sodium Advanced Fast Reactor (SAFR) [Baumeister, 1987], were developed primarily by General Electric (GE) and Rockwell International (RI), respectively. Technical support was provided to DOE, RI, and GE, by the Argonne National Laboratory (ANL), particularly with respect to the characteristics of the metal fuels. There are several examples in both PRISM and SAFR where inherent or passive systems provide for a safe response to off-normal conditions. This is in contrast to the engineered safety systems utilized on current US Light Water Reactor (LWR) designs. One important design inherency in the LMRs is the "inherent shutdown", which refers to the tendency of the reactor to transition to a much lower power level whenever temperatures rise significantly. This type of behavior was demonstrated in a series of unscrammed tests at EBR-II [NED, 1986]. The second key design feature is the passive air cooling of the vessel to remove decay heat. These systems, designated RVACS in PRISM and RACS in SAFR, always operate and are believed to be able to prevent core damage in the event that no other means of heat removal is available. 27 refs., 78 figs., 3 tabs.

2547 (NUREG/CR–5395-Vol.4) **Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4.** Gloudemans, J.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Owners Group, Lynchburg, VA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Jul 1989. 269p. Sponsored by Electric Power Research Institute; Nuclear Regulatory Commission. (EPRI-NP–6480-Vol.4;BAW–2062). Available from NTIS, PC E10/MF E01 - GPO; OSTI; INIS.

This report contains 4 microfiche supplements.

The multiloop integral system test (MIST) is part of a multiphase program started in 1983 to address small-break loss-of-coolant accidents (SBLOCAs) specific to Babcock & Wilcox-designed plants. MIST is sponsored by the US Nuclear Regulatory Commission, and Babcock & Wilcox Owners Group, the Electric Power Research Institute, and Babcock & Wilcox. The unique features of the Babcock & Wilcox design, specifically the hot leg U-bends and steam generators, prevented the use of existing integral system data or existing integral system facilities to address the thermal-hydraulic SBLOCA questions. MIST and two other supporting facilities were specifically designed and constructed for this program, and an existing facility – the once-through integral system (OTIS) – was also used. Data from MIST and the other facilities will be used to benchmark the adequacy of system codes, such as RELAP-5 and TRAC, for predicting abnormal plant transients. 6 refs., 143 figs., 12 tabs.

2548 (NUREG/CR–5395-Vol.6) **Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6.** Gloudemans, J.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Owners Group, Lynchburg, VA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Jul 1989. 340p. Sponsored by Electric Power Research Institute; Nuclear Regulatory Commission. (EPRI-NP–6480-Vol.6;BAW–2065). Available from NTIS, PC E13/MF E02 - GPO; OSTI; INIS.

This report contains 5 microfiche supplements.

The multiloop integral system test (MIST) is part of a multiphase program started in 1983 to address small-break loss-of-coolant accidents (SBLOCAs) specific to Babcock and Wilcox designed plants. MIST is sponsored by the US Nuclear Regulatory Commission, the Babcock & Wilcox Owners Group, the Electric Power Research Institute, and Babcock and Wilcox. The unique features of the Babcock and Wilcox design, specifically the hot leg U-bends and steam generators, prevented the use of existing integral system data or existing integral facilities to address the thermal-hydraulic SBLOCA questions. MIST and two other supporting facilities were specifically designed and constructed for this program, and an existing facility–the Once Through Integral System (OTIS)–was also used. Data from MIST and the other facilities will be used to benchmark the adequacy of system codes, such as RELAP5 and TRAC, for predicting abnormal plant transients. The MIST program is reported in 11 volumes. The program is summarized in Volume 1; Volumes 2 through 8 describes groups of tests by test type; Volume 9 presents inter-group comparisons; Volume 10 provides comparisons between the calculations of RELAP5/MOD2 and MIST observations, and Volume 11 presents the later Phase 4 tests. This Volume 6 pertains to Test Group 34, Steam Generator Tube Rupture. The specifications, conduct, observations, and results of these tests are described. 6 refs., 189 figs., 16 tabs.

2549 (NUREG/CR–5395-Vol.7) **Multiloop integral system test (MIST): Test Group 35, Noncondensibles and venting: Final report: Volume 7.** Gloudemans, J.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Owners Group, Lynchburg, VA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Jul 1989. 353p. Sponsored by Electric Power Research Institute; Nuclear Regulatory Commission. (EPRI-NP–6480-Vol.7;BAW–2066). Available from NTIS, PC E13/MF E01 - GPO; OSTI; INIS.

This report contains 4 microfiche supplements.

The multiloop integral system test (MIST) was a scaled 2-by-4 (2 hot legs and 4 cold legs) physical model of a Babcock & Wilcox (B & W), lowered-loop, nuclear steam supply system (NSSS). MIST was designed to operate at typical plant pressures and temperatures. Experimental data obtained from this facility during post-small-break loss-of-coolant accident (SBLOCA) testing are used for computer code benchmarking. The MIST interactions are of intrinsic interest because they may provide insight into expected plant behavior. MIST was necessarily atypical of a plant in certain important respects, however. The MIST interactions therefore are not to be applied directly to a plant. 5 refs., 239 figs., 11 tabs.

2550 (NUREG/CR–5395-Vol.8) **Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8.** Gloudemans, J.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Electric Power Research Inst., Palo Alto, CA (USA); Babcock and Wilcox Owners Group, Lynchburg, VA (USA); Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.; Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. Jul 1989. 485p. Sponsored by Nuclear Regulatory Commission. (EPRI-NP–6480-Vol.8;BAW–2016). Available from NTIS, PC E15/MF E02 - GPO; OSTI; INIS.

This report contains 6 microfiche supplements.

The multiloop integral system test (MIST) was part of a multiphase program started in 1983 to address small-break loss-of-coolant accidents (SBLOCAs) specific to Babcock & Wilcox-designed plants. MIST was sponsored by the US Nuclear Regulatory Commission, the Babcock & Wilcox Owners Group, the Electric Power Research Institute, and Babcock & Wilcox. The unique features of the Babcock & Wilcox design, specifically the hot leg U-bends and steam generators, prevented the use of existing integral system data or

existing integral system facilities to address the thermal-hydraulic SBLOCA questions. MIST and two other supporting facilities were specifically designed and constructed for this program, and an existing facility – the once-through integral system (OTIS) – was also used. Data from MIST and the other facilities will be used to benchmark the adequacy of system codes, such as RELAP-5 and TRAC, for predicting abnormal plant transients. 7 refs., 321 figs., 14 tabs.

2551 (NUREG/IA–0028) **Review of LOFT [Loss-of-Fluid Test] large break experiments: OECD LOFT project.** Modro, S.M.; Aksan, S.N.; Berta, V.T.; Wahba, A.B. Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. (Austria); Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland); EG and G Idaho, Inc., Idaho Falls, ID (USA); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.). Oct 1989. 152p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A08/MF A01 - GPO; OSTI; INIS.

Six non-nuclear and five nuclear large break loss-of-coolant experiments were performed in the Loss-of-Fluid Test (LOFT) PWR facility at the Idaho National Engineering Laboratory. These experiments provided a large amount of data necessary for evaluation and refinement of reactor system computer codes and had major impact on the understanding of large break loss-of-coolant accidents. An overview of these nuclear large break experiments performed under NRC and OECD LOFT programs is given and the major research results are presented. 55 refs., 89 figs., 5 tabs.

2552 (NUREG/IA–0029) **Assessment of RELAP5/MOD2, Cycle 36.04 against FIX-II split break experiment No. 3051.** Eriksson, J. Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Swedish Nuclear Power Inspectorate, Nykoeping (Sweden). Oct 1989. 78p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A05/MF A01 - GPO; OSTI; INIS.

The FIX-II split break experiment No. 3051 has been analyzed using the RELAP5/MOD2 code. The code version used, Cycle 36.04, is the frozen version of the code. Three calculations were carried out to study the sensitivity of various parameters to the change of break discharge and passive heat structures. The differences between the calculations and the experiment have been quantified over intervals in real time for a number of variables available from the measurements during the experiment. 8 figs., 8 tabs.

2553 (ORNL/FTR–3437) **[Integrity of pressure components of nuclear power plants]: Foreign trip report, October 3, 1989–October 20, 1989.** Merkle, J.G. Oak Ridge National Lab., TN (USA). 3 Nov 1989. 56p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. Order Number DE90002654. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The traveler attended the 15th annual MPA Seminar at the University of Stuttgart and the European Symposium on Elastic-Plastic Fracture Mechanics (EPFM) at Freiburg, FRG. Following the symposium the traveler made visits to the IWM Laboratory in Freiburg, FRG, the GKSS Research Center in Geesthacht, FRG, the Welding Institute in Cambridge, UK, and the Structural Integrity Centre at Risley, Warrington, UK. Principal subjects of discussion during the laboratory visits were the measurement of fracture toughness in the upper transition temperature range and the possibility of cooperative analytical and experimental efforts concerning the effects of biaxial stresses on fracture toughness for finite length surface cracks in plates and pressure vessel cylinders.

2554 (PB–89-870505/XAB) **Nuclear reactor accidents: Chernobyl, TMI (Three Mile Island), and Windscale. January 1974-September 1989 (Citations from Pollution Abstracts). Report for January 1974-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 74p. Available from NTISPC N01/MF N01.

Supersedes PB–89-851133.

This bibliography contains citations concerning studies and measurements of the radiological consequences of nuclear reactor accidents. The citations cover specifically the Chernobyl reactor in the USSR, the Three Mile Island (TMI) reactor in the US, and the Windscale reactor in the UK. Included are detection and monitoring of the fallout, the resultant runoff into rivers, lakes, the sea, the radiation effects on people, and the transfrontier radio ative contamination of the environment. (This updated bibliography contains 164 citations, 59 of which are new entries to the previous edition.)

2555 (SIEMENS-KWU-U9–414/88/022) **Experimental analysis of the behavior of iodine in the event of hypothetical accidents - iodine partition coefficients (follow-on project). Final report.** Bleier, A.; Greger, G.U.; Gropp, C. Siemens A.G. Unternehmensbereich KWU, Erlangen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Nov 1988. 60p. (In German). Contract BMFT 1500 709/A2. Order Number DE90722092. Available from NTIS (US Sales Only), PC A04/MF A01.

In the event of a severe reactor accident involving core meltdown, sumps containing fission iodine can form in the annulus and in the auxiliary building of a PWR. Iodine revolatilization from these sumps has to be considered. The report contains results of clean conditions tests performed to determine relevant I_2 partition coefficients. In the case of I_2 input only, the I_2 partition coefficient rises from initially 7000 to 250000 within 2-3 hours whereas it rises for I_2/I^- input from 300 up to 57000 in about the same time. These findings were used in the concluding discussion of results from previous iodine revolatilization experiments. It appears as if high values of the partition coefficient under clean conditions cannot be achieved when there is realistic contact of the sump with organically coated surfaces. (orig.) With 17 refs., 11 tabs., 6 figs.

2556 **A new initiative on radiation coordination in the federal government.** Young, A.L. (Office of Science and Technology Policy, Executive Office of the President, Washington, DC (US)); Dix, G.P. vp. of Proceedings of the American Nuclear Society executive conference on good radiation protection management. American Nuclear Society, La Grange Park, IL (1985). (CONF-841223–: ANS executive conference on dollars and sense in good radiation protection management, San Diego, CA (USA), 9-12 Dec 1984).

The Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) is comprised of members of the 15 federal agencies involved in radiation. This paper describes CIRRPC–its goals, its progress, some of the national radiation issues, and observations in starting up. Based upon the wreckage of past initiatives in this area over the last 15 years, since the demise of the Federal Radiation Council in 1970, there was some initial skepticism that CIRRPC could survive or succeed in its goals. However, the members and staff of CIRRPC are dedicated to its success.

2557 **Radiological dose calculations for the chamber and diode region of the light ion fusion target development facility.** Yasar, O. (Fusion Technology Institute, Univ. of Wisconsin-Madison, 1500 Johnson Drive, Madison, WI (USA)); Sawan, M.E.; Henderson, D.L.; Moses, G.A. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Biological dose rate calculations are performed for two preliminary designs of the Light Ion Fusion Target Development Facility (TDF) for times following an operational period of one month. The primary wall material considered is aluminum Al-6061-T6 with an alternative material being 2-1/4 Cr-1 Mo steel. The diode material considered is SS304LN stainless steel and the penetration in the chamber wall is 10 cm in radius. As an alternative to the base case 3 m radius chamber design, a 1 m radius chamber is analyzed with various shield materials - borated water, concrete and graphite between the chamber wall and the diode. The dose rate behind the Al first wall for the 3 m chamber design is 34.5 mrem/hr at 1 week after shutdown. For the 1 m chamber design this number is 8.4 rem/hr with an aluminum first wall, and 5 rem/hr with a steel first wall. For the diode region calculations, the first wall is taken as Al-6061-T6 for both the 1 m and 3 m cases. The dose rate at the point external to the diode vacuum casing, one week after shutdown, is 24 mrem/hr for the 3 m case. For the 1 m case, the dose rates at one week after shutdown are 3.7, 3.8 and 5.8 mrem/hr with shield materials of borated water, concrete and graphite, respectively.

2558 **Success/simplicity/safety/savings: SI/trip reduction at Indian point 2.** Ginsberg, A.P.; Mooney, J.; Brandstaedter, M.; Misilo, S.; Speyer, D.M.; Gasperini, J.; Ament, G. *Transactions of the American Nuclear Society (USA),* 57: 171-172 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

In the 1980s, Consolidated Edison embarked on a unique, ambitious program of safety injection (SI)/trip reduction for its Indian Point Unit 2, four-loop Westinghouse 2758-MW (thermal), pressurized water reactor. The program had the following criteria: 1. Each SI/trip reduction modification should successfully eliminate a majority of unnecessary SI/trips of a specific type. 2. The hardware changes must be simple, having a minimum effect on operations, testing, and maintenance, and be cost-effective. 3. The modifications must retain a significant degree of safety margin, and where possible, be done under 10CFR50.59. Four specific SI/trip classes have been addressed. They are loss-of-feedwater trips, direct reactor trips on turbine generator trips, spurious SI/trips involving high steam flow, and trips following transients resulting from turbine runbacks. Significant results of the program, which involved new solutions to common industry problems, are described. The modifications involved simple schemes and were easily installed at a reasonable cost. Most were done with only one technical specification change required. Based on recent operational data and past trip experience, it is estimated that two to three reactor trips and/or SIs will be avoided per year.

2559 **Maanshan T_pS_LB accident analysis.** Chen, C.C.; Wang, T.K.; Hsueh, J.K. *Transactions of the American Nuclear Society (USA),* 57: 174-176 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

An T_pS_LB accident analysis for Taipower's Maanshan Unit 1 plant is reported. The plant is a 2775-MW(thermal) pressurized water reactor with large dry containment. Based on Maanhshan level-1 probabilistic risk assessment, the T_pS_LB sequence ranks first in accident frequency. The basic definition of T_pS_LB includes loss-of-off-site power T_p, station blackout, loss of all alternating current power B, and the occurrence of a loss-of-coolant accident (LOCA) due to main coolant pump seal failure, i.e., seal LOCA S_L. The results of a base case study are summarized first. These results are then compared with other studies by varying some key parameter values. All calculations were done with MAAP 3.0 computer code. In the base case study, seal LOCA was assumed to occur 3 h after the initiation of the vent. The LOCA break area was assumed to be 0.169×10^{-3} m^2. Leakage occurred in all three loops. Containment (CTMT) failure pressure was set at 120 psig. The containment break area was set at 0.003 m^2, attempting to keep the pressure roughly constant after containment failure. In the station blackout situation, the direct current power in the Maanshan plant would last 2 h. Accordingly, in the calculations we assumed the turbine-driven auxiliary feedwater and the power-operated relief valves would also be working for 2 h. The major event sequences, including times of core uncovery, vessel failure, and containment failure as well as the resulting fission product release fractions at different time spans after containment failure, are listed. Also listed are the results of other studies.

25 ENERGY STORAGE

2504 Capacitor Banks

2560 (AD-A–210366/1/XAB) **Capacitive energy storage at cryogenic temperatures. Phase 2. Final report, 1 January 1986-31 December 1988.** Clark, C.F. CeramPhysics, Inc., Westerville, OH (USA). 12 Feb 1989. 148p. Available from NTIS, PC A07/MF A01.

The primary goal of this Phase II program was to improve the dielectric breakdown strength of ceramic multilayer capacitors (MLC's) in order to improve capacitive energy storage at liquid-nitrogen temperatures. A secondary goal was to explore the reproducibility of a field-enforced state-switching effect discovered in the Phase I program. The ceramic composition involved in these programs is designated as CPN17 and has a dielectric constant in the range 8,000-10,000 at 77 K. Several variations in conventional ceramic-processing parameters were studied, leading to systematic improvements in the breakdown strength at 77 K (160 to 250 to 400 kV/cm).

2505 Flywheels

2561 (NEI-DK–224) **Electromagnetic flywheel energy storage for use in electric powered trucks and vehicles for domestic transport.** Nissen, O.S. Laboratoriet for Energiforskning, Odense (Denmark). Jan 1987. 61p. (In Danish). Order Number DE90719259. Available from NTIS (US Sales Only), PC A04/MF A01.

EFP-85.

The aim was to develope a small lightweight electromagnetic motor/generator flywheel-buffer energy storage component that is an integrated and sealed unit without gearage components to be utilized in electric-powered vehicles used for domestic transport. The buffer storage is used during acceleration and regenerative braking and should prevent overloading of the batteries. In this way the flywheel energy storage effect will enable the gathering and returning of regenerative braking energy. This will mean that the vehicle's needs in relation to battery capacity can be reduced. In this system it is the flywheel that is the true energy storge facility. The motor/generator, converter and control unit will thus function only as transmission, steering and monitoring systems. (AB).

2562 (RISO-M–2803) **Flywheel for vehicles.** Waagepetersen, G. Risoe National Lab., Roskilde (Denmark). Jun 1989. 55p. (In Danish). Order Number DE90718933. Available from NTIS (US Sales Only), PC A04/MF A01.

EFP-86.

A new type of flywheel is designed to use the brake effect of a vehicle to subsequent start and accelleration. The best existing flywheels for busses have rim and hub made of fiber reinforced composite with an adhesive joint to a steel shaft with a relative little diameter. Hub and adhesive are influenced by big forces among others from gyro moments. The stress situation is complicated, and it has been necessary to have 4 hubs and totally 8 adhesive joints. The new flywheel has no hub but transmit these forces simple and directly as shear, tension and compression to a supporting structure of light metal. There is only one adhesive joint placed at a rather big diameter, where the shear stresses are small as they are reduced with a factor 0.16. This design is much stronger than a hub for all actual forces, and therefore the wheel can run with higher revolutions. As the mass distribution is also better, it means that the wheel with unaltered weight and volume can store about 100% more energy and give 200% bigger effect. In case of a traffic accident the new wheel can stand 100 g in all directions. (author).

2506 Thermal

Refer also to citation(s) 2320, 2493

2563 (DOE/CE/15449–T1) **Fuel savings in the heavy trucking industry through cool storage: Technical progress report, June 20–September 19, 1989.** Instatherm Co., Cary, NC (USA). [1989]. 4p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-89CE15449. Order Number DE90001469. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Complete the development and bench testing of a full size engineering prototype for the system and initiate the in-vehicle testing of the unit. Three of the four modules, that make-up the engineering prototype, were completed prior to the start of this DOE program. The fourth module required repackaging, because of inadequate insulation and this was accomplished. 2 figs.

2564 (EPRI-CU–6561-Vol.1) **Operation and performance of commercial cool storage systems: Volume 1, 1987 cooling season.** Merten, G.P.; Shum, S.L.; Sterrett, R.H.; Racine, W.C. Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., San Diego, CA (USA). c Sep 1989. 171p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The performance of six cool storage installations was monitored and analyzed with participating electric utilities, under the Electric Power Research Institute (EPRI) Commercial Cool Storage Field Performance Monitoring Project (RP 2732-05). The objective of this project is to provide information on the performance of cool storage systems to improve the system design and operation, and thereby the economics of such systems. In this report the cool storage system performance and impact of cool storage on the site electric demand and energy use is discussed. The performance of chilled water, electric salt, and ice storage systems is compared to each other and to the performance of non-storage, conventional air conditioning systems. Recommendations to improve system performance are made and fall into three areas: (1) integration of the cool storage system and building HVAC system, (2) system maintenance, and (3) storage tank design and operation. 2 refs., 14 figs., 4 tabs.

2565 (EPRI-CU-6561-Vol.2) **Operation and performance of commercial cool storage systems: Volume 2, 1988 cooling season and project summary.** Merten, G.P.; Shum, S.L.; Sterrett, R.H.; Racine, W.C. Electric Power Research Inst., Palo Alto, CA (USA); Science Applications International Corp., San Diego, CA (USA). c Sep 1989. 137p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

EPRI initiated the Commercial Cool Storage Field Performance Monitoring Project (RP2732-05) to provide cool storage system performance data for use in improving system design, operation and economics. In cooperation with twelve participating utilities, cool storage systems were monitored and analyzed at six commercial buildings in 1987 and at seven buildings in 1988. This final report discusses the impacts of monitored cool storage systems on site electric demand and energy use patterns. The chiller and auxiliary equipment energy consumption and storage tank thermal performance are discussed for chilled water, eutectic salt and ice storage systems. A conventional air conditioning system is simulated for each site and its performance is compared with the cool storage system's monitored performance. Recommendations are made to utilities and system designers to help their customers improve system performance and operation. 3 refs., 10 figs., 5 tabs.

2566 (PB-89-871628/XAB) **Thermal energy storage. July 1987-September 1989 (Citations from the NTIS data base). Report for July 1987-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 120p. Available from NTISPC N01/MF N01.

Supersedes PB-88-868831.

This bibliography contains citations concerning thermal energy storage in reservoirs, aquifers, rock beds, molten salts, and manufactured storage devices, such as Trombe walls, direct gain cells, and phase-change materials for solar heating and spacecraft. The citations cover the design, evaluation, theory, and materials used. Some citations report on effects of using certain storage media, such as aquifers. (This updated bibliography contains 217 citations, 88 of which are new entries to the previous edition.)

2509 Batteries

Refer also to citation(s) 2612, 2658, 2790, 2791, 2792, 2793

2567 (AD-A-210755/5/XAB) **Lithium-polymer-electrolyte battery: Electrochemical behavior of cathode materials. Technical report, July 1988-June 1989.** Scrosati, B.; Selvaggi, B.; Owens, B.B.; Munshi, M.Z. Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center. 15 Jun 1989. 3p. (TR-2). Available from NTIS, PC A02/MF A01.

Thin-layer, lithium-polymer-electrolyte batteries have reached an advanced stage of development. All prototypes use insertion compounds of various composition and structures as the active cathode material. Titanium disulfide, vanadium oxide and lithium vanadium bronze, respectively, were tested under comparable conditions as the active electrode materials. The characteristics of the interfaces were examined by cyclic voltammetry, impedance spectroscopy, and intercalation-deintercalation cycling and the results of this study are reported in this work.

2568 (AD-A-210786/0/XAB) **Cell performance of ultra-thin polymer-cathode system: Theoretical energy and power-density projections. Technical report No. 3, July 1988-June 1989.** Naoi, K.; Owens, B.B.; Smyrl, W.H. Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center. 15 Jun 1989. 3p. Available from NTIS, PC A02/MF A01.

Theoretical energy and power-density values for thin film lithium/liquid electrolyte/polymer cell systems were calculated by designing a specific cell model for both a prismatic cell with only the basic cell elements (no hardware) and a bipolar-design cell with some idealized practical hardware. The cell performance is compared for three different cathode-polymer materials, viz., polyaniline, polypyrrole, and polyvinylferrocene. The energy and power densities are estimated as a function of cathode thickness, active cell area, and initial concentration of electrolyte for very thin cathode films (cathode thickness: Lc=1 to 100 micrometer in both single-cell and bipolar designs). The energy and the power are estimated at 80 Wh/kg and 800 kW/kg for 10 micrometer cathodes. Problems of the battery manufacturing process were not addressed.

2569 (AD-A-210789/4/XAB) **Use of lithium batteries in biomedical devices. Technical report No. 8, July 1988-June 1989.** Owens, B.B. Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center. 15 Jun 1989. 4p. Available from NTIS, PC A02/MF A01.

Lithium batteries have played an important role in the development of useful implantable biomedical devices. The cardiac pacemaker is the most well known of these devices and high-energy, long-life reliable lithium primary cells have effectively replaced all of the alkaline cells previously used in these electronic systems. The recent development of higher-power devices such as drug pumps and cardiac defibrillators require the use of batteries with higher energy and power capabilities. High rate rechargeable batteries that can be configured as flat prismatic cells would be especially useful in some of these new applications. Lithium polymer electrolyte-batteries may find a useful role in these new areas.

2570 (AD-A-210978/3/XAB) **Rechargeable lithium/polymer cathode batteries. Technical report, July 1988-June 1989.** Osaka, T.; Nakajima, T.; Shiota, K.; Owens, B.B. Minnesota Univ., Minneapolis, MN (USA). Dept. of Chemical Engineering and Materials Science. 15 Jun 1989. 4p. (TR-6-ONR). Available from NTIS, PC A02/MF A01.

Polypyrrole (PPy) and polyaniline (PAn) were investigated for cathode materials of rechargeable lithium batteries. PPy films prepared with PF6(-) anion and/or Platinum substrate precoated with nitrile butadiene rubber(NBR) were excellent cathode materials because of rough and/or highly oriented film structure. PAn films were successfully prepared from non-aqueous propylene carbonate solution containing aniline, CF_3COOH and lithium perchlorate. Its acidity strongly affects the anion doping-undoping behavior. The Pan cathode prepared in high acidic solution (e.g. 4:1 ratio of acid:aniline) gives the excellent battery performance.

2571 (AD-A-210979/1/XAB) **Impedance analysis of ionic transport in polypyrrole-polyazulene copolymer and its charge-discharge characteristics. Technical report, July 1988-June 1989.** Naoi, K.; Ueyama, K.I.; Osaka, T.; Smyrl, W.H. Minnesota Univ., Minneapolis, MN (USA). Dept. of Chemical Engineering and Materials Science. 15 Jun 1989. 27p. (TR-7-ONR). Available from NTIS, PC A03/MF A01.

Ionic-transport behavior across an electropolymerized polypyrrole/polyazulene composite film was investigated by using ac impedance analysis, and its charge-discharge characteristics were also studied. Co-electropolymerization of pyrrole and azulene was well defined and fairly stoichiometric in propylene carbonate solution. The charge capacity for the composite films showed a remarkable increase for films around 50 to 75% of azulene monomer content, and the behavior was correlated with morphological and diffusivity changes. The charge-discharge characteristics were examined for cells with a lithium anode and various polypyrrole/polyazulene composite cathodes. Pure polypyrrole cathodes behaved exactly like a capacitor at low frequency, while pure polyazulene cathodes showed excellent rechargeable behavior with very flat discharge curves. Composite cathodes showed intermediate behavior.

2572 (AD-A-211254/8/XAB) **Battery actuation of NITINOL at sub-zero temperatures.** Goldstein, D. Naval Surface Warfare Center, Silver Spring, MD (USA). Apr 1989. 22p. (NSWC-TR-89-110). Available from NTIS, PC A03/MF A01.

It is feasible to use batteries to produce rapid shape-memory response in NITINOL wires in sub-zero temperature ambients. Data are presented on lithium thionyl chloride batteries used to joule heat 10-mil-diameter wires of nominal transformation temperatures of 90-105 C. The batteries and wires were jointly tested in a -35C ambient air environment. The wire contracted 5% in length (0.4 inch) and lifted a 1 pound load in 1/2 second.

2573 (CONF-891132-7) **Sodium/sulfur post-test analysis at ANL.** Smaga, J.A. Argonne National Lab., IL (USA). [1989]. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 9. battery and electrochemical contractors' conference; Alexandria, VA (USA); 13-17 Nov 1989. Order Number DE90001911. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

One activity of Argonne's Analysis and Diagnostics Laboratory has been the examination of selected sodium/sulfur cells that were built and tested by Chloride Silent Power Ltd. (CSPL) as part of the Exploratory Battery Technology Development Program at Sandia National Laboratories. The more recent examinations have involved long-lived (>400 cycles) cells of both basic cell designs (PB and XPB). The examined cells can be further differentiated according to the different designs used for the seal assembly and the sodium electrode. The detailed examinations conducted with the specialized facilities maintained at ANL have led to some significant findings stemming from these design variations. Some of the results for case corrosion, electrolyte contamination, and seal degradation are presented, and the effect of the design changes on these conditions is discussed. 3 figs.

2574 (CONF-891132-8) **Status and results of ANL life evaluation of valve-regulated lead-acid load-leveling batteries.** DeLuca, W.H.; Miller, J.F.; Webster, C.E.; Hogrefe, R.L. Argonne National Lab., IL (USA). [1989]. 6p. Sponsored by Electric Power Research Institute; International Lead Zinc Research Organization (ILZRO). DOE Contract W-31109-ENG-38. From 9. battery and electrochemical contractors' conference; Alexandria, VA (USA); 13-17 Nov 1989. Order Number DE90001918. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Argonne National Laboratory has developed and initiated a three-year life evaluation of both gelled-electrolyte and absorbed-electrolyte valve-regulated lead-acid (VRLA) battery technologies for deep-discharge applications. The objectives are (1) to use accelerated testing techniques to obtain data within 6 months on VRLA battery life expectancy, and (2) to determine VRLA battery life within a 2-3 year time period under temperature and depth-of-discharge (DOD) conditions that simulate those encountered in a utility load-leveling environment. The accelerated life test uses a matrix of operating conditions designed to increase the stress of known failure modes, thereby accelerating the mechanisms that cause battery end-of-life. The primary failure mode is expected to be active material changes caused by charge-discharge cycling (i.e., microstructural and morphological changes, sulfation, mass isolation, loss of surface area, loss of porosity, etc). The test matrix consists of four sets of operating conditions (80% and 100% DOD and 30°C and 50°C temperature), which include the stress factors to accelerate failure.

2575 (CONF-8905126-7) **Calorimetric measurements on electrochemical cells with Pd-D cathodes.** Redey, L.; Myles, K.M.; Dees, D.; Krumpelt, M.; Vissers, D.R. Argonne National Lab., IL (USA). [1989]. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Workshop on cold fusion phenomena; Santa Fe, NM (USA); 23-25 May 1989. Order Number DE90002198. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Two series of experiments were performed to determine the conditions of cell operation that produce sufficient heat to be useful for the production of energy. In the first series, the results from a differential temperature analysis of identical light- and heavy-water electrochemical cells were too ambiguous and, thus not suitable for evaluating excess heat effects. In the second series, two Pd-D/LiOD-saturated D_2O/Pt cells were operated at current densities between 15 and 500 mA/cm^2 in a constant-heat-loss-rate twin calorimeter for 460 hours. Water loss measurements during the experiments indicated that the recombination reaction ($D_2 + O_2 \rightarrow D_2O$) did not occur. The D/Pd ratio was determined gravimetrically during the experiments. No excess heat was found within the sensitivity (0.13 W, 0.082 W/cm^3 of Pd, 0.013 W/cm^2 of Pd) and precision (±0.3 W) of the calorimeter. 11 refs., 11 figs.

2576 (DOE/ID-10243) **Assessment of battery technologies for electric vehicles: Volume 1.** Ratner, E.Z.; Symons, P.C.; Walsh, W.; Warde, C.J.; Henriksen, G.L. (eds.). EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1989. 63p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE90002049. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

To help guide future EV battery R&D programs, the US Department of Energy (DOE) commissioned a comprehensive assessment of viable secondary battery technologies. A total of 55 battery developers – from the United States, Canada, Europe, Asia, and Africa – were solicited to submit battery design concepts for an "Improved Dual-Shaft Electric Propulsion" (IDSEP) van. A team of 7 representatives from DOE laboratories and 10 independent EV and Battery consultants evaluated 42 design concepts. Using six criteria – five technical/economic criteria and a maturity/technical barriers criterion – the Assessment Team identified 12 most-promising batteries. 11 refs., 5 figs., 16 tabs.

2577 (EGG-M-88115) **A simplified battery discharge profile based upon the federal urban driving schedule.** Cole, G.H. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-881162-4: 9. electric vehicle symposium, Toronto (Canada), 13-16 Nov 1988). Order Number DE90002016. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A battery discharge test consisting of twenty steps of five constant power levels was developed by the US Department of Energy sponsored Battery Test Working Task Force. The results of this battery test closely approximate the results obtained from a battery discharge in the hypothetical improved Dual-Shaft Electric Propulsion (IDSEP) van over the Federal Urban Driving Schedule. This battery test (known as the SFUDS79) is described and the results of terminating the discharge at a minimum battery voltage for various batteries are presented and compared to a FUDS discharge. A test termination criteria based upon power limits that would predict the vehicle range over the SAE J227 FUDS test procedure is given and a method of scaling the specific power vs time profile of the test cycle for EV batteries is proposed. The effect of rest periods between discharge cycles from experimental data is also presented. 3 refs., 7 figs., 3 tabs.

2578 (LBL-27037) **Technology Base Research Project for electrochemical energy storage: Annual report for 1988.** Kinoshita, Kim (ed.). Lawrence Berkeley Lab., CA (USA). May 1989. 28p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002604. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report summarizes the progress made by the Technology Base Research (TBR) Project for Electrochemical Energy Storage during calendar year 1988. The primary objective of the TBR Project, which is sponsered by the Department of Energy (DOE) and managed by Lawrence Berkeley Laboratory (LBL), is to identify electrochemical technologies that can satisfy stringent performance and economic requirements for electric vehicles and stationary energy storage applications. The ultimate goal is to transfer the most-promising electrochemical technologies to the private sector or to another DOE project (e.g., SNL's ETD Project) for further development and scale-up.

2579 (LBL-27466) **The secondary slurry-zinc/air battery: Final report.** Sierra Alcazar, H.B.; Nguyen, P.D.; Mason, G.E.; Pinoli, A.A. Lawrence Berkeley Lab., CA (USA); Pinnacle Research Inst., Cupertino, CA (USA). Jul 1989. 47p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002600. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The rechargeability of the slurry-Zn/air battery was demonstrated with a practical recharge cell that requires minimal hydraulic and mechanical energy for operation. A dendritic Zn was deposited on a Mg plate substrate from which it was easily, periodically and automatically scraped to regenerate dendritic Zn slurries. Excellent discharge results were obtained with the regenerated dendritic Zn slurry, comparable to those obtained with slurries made with mixtures of Zn powder. The dendritic Zn slurry allowed, however, twice the utilization of Zn. 13 refs., 24 figs., 2 tabs.

2580 (PB–89-870646/XAB) **Lithium batteries. October 1987-September 1989 (Citations from the COMPENDEX data base). Report for October 1987-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 118p. Available from NTISPC N01/MF N01.

Supersedes PB–88-869136.

This bibliography contains citations concerning the design, development, and applications of lithium batteries. Topics include electrochemical aspects, cycling characteristics, performance evaluations, and applications in cardiac pacemaker devices. Batteries utilizing organic compounds, chlorides, and metal sulfides are discussed. (This updated bibliography contains 240 citations, 100 of which are new entries to the previous edition.)

2581 (UCRL–21229) **High-power-density prime power systems: A literature search and analysis.** Hamby, D.C. Lawrence Livermore National Lab., CA (USA); Linfield Coll., McMinnville, OR (USA). Research Inst. 1 Jun 1989. 111p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90002527. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The electrical characteristics of the loads to be faced by the power source are given. Two loads are inductive-resistive; one to be brought to a specified flux in the inductor and one to be brought to a specified energy in the inductor within stated time limits which are of the order of milliseconds. The third load is capacitive-resistive and the capacitor is to be brought to a specified voltage in a period of seconds. Charge (a few Coulombs) and energy (about 10^5 Joules) requirements of the loads are modest compared to the capabilities of common automotive batteries; however, the average power demands of the loads are high (25 to 50 MW or higher for the inductive-resistive loads). Source voltages required to drive the specified loads are much larger than those of common batteries. The literature indicates that the way to achieve the required voltages at high power density and specific power is to utilize thin cell bipolar batteries, a bipolar design offers potential advantages of low cell resistance and weight, and uniformity of electrode current density. 123 refs., 31 figs., 3 tabs.

2582 **Laboratory evaluation of advanced battery technologies for electric vehicle applications.** DeLuca, W.H.; Kulaga, J.E.; Hogrefe, R.L.; Tummillo, A.F.; Webster, C.E. 6p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890820.

During 1988, battery technology evaluations were performed for the Department of Energy and Electric Power Research Institute at the Argonne Analysis and Diagnostic Laboratory. Cells and multicell modules from four developers were examined to determine their performance and life characteristics for electric vehicle propulsion applications. the results provide an interim measure of the progress being made in battery R and D programs, a comparison of battery technologies, and a source of basic data for modeling and continuing R and D. This paper summarizes the performance and life characterizations of twelve single cells and six 3- to 24-cell modules that encompass four technologies (Na/S, Ni/Fe, lead-acid, and Fe/Air).

2583 **Analysis of life cycle costs for electric vans with advanced battery systems.** Marr, W.W.; Walsh, W.J.; Miller, J.F. 6p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890819.

The performance of advanced Zn/Br_2, LiAl/FeS, Na/S, Ni/Fe, and Fe/Air batteries in electric vans was compared to that of tubular lead-acid technology. The MARVEL computer analysis system evaluated these batteries for the G-Van and IDSEP vehicles over two driving schedules. Each of the advanced batteries exhibited the potential for major improvements in both range and life cycle cost compared with tubular lead-acid. A sensitivity analysis reveals specific energy, battery initial cost, and cycle life to be the dominant factors in reducing life cycle cost for the case of vans powered by tubular lead-acid batteries.

2584 **Electric vehicle battery R and D in the context of a propulsion system.** Patil, P.G.; Christianson, C.C.; Miller, J.F. 6p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890817.

A battery system for an electric vehicle should be designed and developed in concert with the other components of the propulsion system. Technology development efforts sponsored by the U.S. Department of Energy are addressing all the constituent electric vehicle component technologies, including the battery subsystem technologies, from the perspective of the complete propulsion system. This approach is considered to be essential for three reasons. First, the ultimate viability of a given battery technology can only be assured in the context of a complete propulsion system. Second, many required battery subsystem technology advancements can only be addressed in concert with the other propulsion system components. Third, development and testing of battery subsystem technologies in conjunction with powertrain subsystem technology development is necessary in order to provide essential information to the battery developer and to the vehicle developer that can not be obtained when battery development is performed as a discrete activity.

2585 **Evaluation of state-of-charge indicator approaches for EVs.** Burke, A.F. 11p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890816.

Studies of battery management systems(BMS), including state-of-charge(SOC) algorithms, were performed in the Battery Test and Vehicle Dynamometer Laboratories at the INEL. The test and evaluation of the SOC algorithms indicated that the capacity rate dependent and adaptive approaches to determining battery SOC yielded RMS errors between the indicated and actual states-of-charge of less than 10% if battery temperature and aging effects were not dominate. The BMS tested were not sufficiently accurate and reliable to permit their use as the primary means of charge control during the various INEL test programs. Considerable progress has been made in the development of BMS, but further work is needed before the systems can be used with confidence in either the charge or discharge modes without careful attention from the user.

2586 **Li/FeS battery design for an electric van.** Chilenskas, A.A.; Barlow, G. 4p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890785.

Li-alloy/FeS battery designs, based upon a well-characterized 300-Ah cell developed by Westinghouse Oceanic Division, have been developed for four electric vans currently under development by the U.S. Department of Energy and the Electric Power Research Institute. Computerized cell models were developed to calculate power, energy, weight, and volume values for a cell while varying key design parameters. Battery specifications and vehicle performance are given for the Chrysler TE Van, GMC G-Van, For ETX-11, and the Eaton DSEP.

2587 **Development of advanced battery systems for vehicle applications.** Zagrodnik, J.P.; Eskra, M.D.; Andrew, M.G.; Gentry, W.O. 3p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890783.

The Advanced Battery Business Unit (ABBU) of Johnson Controls, Inc. is developing several promising advanced battery technologies including flow-through lead-acid, zinc/bromine, and nickel hydrogen. The flow-through lead-acid technology, which is being developed under Department of Energy (DOE) sponsorship, is progressing towards the fabrication of a 39 kWh battery system. Recent efforts have focused on achieving the aggressive specific energy goal of 56 Wh/kg in 12 volt module form. Recent DOE sponsored work in the zinc/bromine program has focused on the development of a proof-of concept 50 kWh electric vehicle system for a light van application. Efforts in the nickel hydrogen program have focused on reducing system cost in order to make the life-time premium market and EV market possible targets. The status and future direction of each of these programs are summarized.

2588 **Assessment of EV batteries and application to R and D planning.** Henriksen, G.L.; Patil, P.G.; Ratner, E.Z.; Warde, C.J. 7p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890781.

To guide future EV battery R and D programs, the U.S. Department of Energy (DOE) commissioned a comprehensive assessment of secondary battery technologies. A total of 67 battery developers - from the United States, Canada, Europe, Asia, and Africa - were solicited to submit battery design concepts for an "Improved Dual-Shaft Electric Propulsion" (IDSEP) van. A team of 10 consultants and 7 representatives from DOE laboratories evaluated 42 developer responses and consultant-prepared designs. Using six criteria - five technical/economic criteria and a maturity/technical barriers criterion - the assessment identified 12 most-promising batteries. Employing a generic EV-battery development-system framework, the assessment results are being used to formulate multi-year R and D plans and schedules for the most-promising developmental batteries.

2589 **Zinc electrode and rechargeable zinc-air battery.** Ross, P.N. Jr. To Dept. of Energy, Washington, DC. USA Patent 4,842,963. 27 Jun 1989. Filed date 21 Jun 1988. USA Patent Application 7 209,592. Int. Cl. H01M 8/06. 12p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an improved zinc electrode for a rechargeable zinc-air battery comprising an outer frame and a porous foam electrode support within the frame which is treated prior to the deposition of zinc thereon to inhibit the formation of zinc dendrites on the external surface thereof. The outer frame is provided with passageways for circulating an alkaline electrolyte through the treated zinc-coated porous foam. A novel rechargeable zinc-air battery system is also disclosed.

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 4550

2590 (ETDE-mf–0722300) **Energy report 1987/88.** Ministerium fuer Wirtschaft, Mittelstand und Technologie des Landes Baden-Wuerttemberg, Stuttgart (Germany, F.R.); Statistisches Landesamt Baden-Wuerttemberg, Stuttgart (Germany, F.R.). 1989. 63p. (In German). Order Number DE90722300. Available from NTIS (US Sales Only), PC A04/MF A01.

The report reviews Baden-Wuerttemberg's energy policy from a national and international view. It shows that reliable, low-cost, and non-polluting energy supply is assured and that the main goals of the Land's energy policy have been reached. Figures are given for 1987 and, as far as possible, also for 1988. (orig./UA).

2902 Economics and Sociology

Refer also to citation(s) 2144, 2282, 2283, 2285, 2286, 2627, 2647, 2712, 2714, 3408, 4501

2591 (CONF-8909254–1) **The slowdown of 1989–90: Further evidence for the use of transportation sector indicators to predict GNP growth.** Santini, D.J. Argonne National Lab., IL (USA). [1989]. 33p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Forecasting in the Transportation Sector session; Philadelphia, PA (USA); 27-28 Sep 1989. Order Number DE90001982. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Research on the interaction of energy cost shocks and macroeconomic activity one year later is reviewed and used to support a prediction that early 1989 increases in crude oil and gasoline prices will lead to declines of auto sales for each of the next three quarters, depressing macroeconomic growth rates in early 1990. Research on the interaction of major product group real cost changes and macroeconomic activity changes one year later is reviewed, showing that energy products are the only products for which statistical evidence supporting a negative interaction exists when using a full century of US data. The post 1929 interactions of various energy types are then examined, showing that gasoline is the fuel which has been responsible for the energy effect since that time. Literature is cited supporting the argument that declines in vehicle sales occur in response to gasoline price increases, and that declines in vehicle sales for the dominant vehicle producer predict GNP. A study showing that regulatory cost increases as well as gasoline price increases depress auto sales is cited. The unfortunate coincident timing of increases in the safety, emissions, and/or fuel economy regulatory costs of the automobile and gasoline price shocks at approximately the time of the last three US recessions is reviewed and compared to the 1989–90 situation. Factors which tend to support an expectation of further rises in crude oil and/or gasoline prices in 1990 are reviewed, and contrasted with those factors tending to support a "soft landing" scenario. 48 refs., 22 figs.

2592 (CONF-8911108–1) **Community relations programs: Improved planning through better understanding of communication systems.** Reeme, T.L.; Young, C.F. Argonne National Lab., IL (USA). [1989]. 15p. Sponsored by U.S. Department of Defense. DOE Contract W-31109-ENG-38. From Superfund '89 conference; Silver Spring, MD (USA); 27-29 Nov 1989. Order Number DE90001909. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Thorough and situation-specific planning is often neglected during development of community relations programs. However, planning is critical to developing effective and ultimately successful programs. Such planning involves several steps: setting goals and objectives, identifying community characteristics, understanding communication systems, determining target audiences, and developing an evaluation scheme. Although crucial to effective planning, the step "understanding communication systems" is often overlooked. This paper therefore emphasizes the importance of understanding communication systems, but also includes brief descriptions of each of the other planning steps. Communication systems generally have seven components or aspects: objects (e.g., receivers, senders, and communication media and messages), attributes of objects, relationships among objects, environments in which the system functions, balance, hierarchical organization, and goal orientation. Each of these components or aspects is described as it pertains to community relations programs, and the main methods for obtaining information about each component or aspect are discussed. 8 refs., 3 tabs.

2593 (CONF-8911117–1) **Disasters and market response: An economists perspective on the management of urban emergencies.** Horwich, G. Oak Ridge National Lab., TN (USA). [1989]. 34p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Conference on energy in Milan: the past, the present, and the future of energy in a modern city; Milan (Italy); 10-11 Nov 1989. Order Number DE90002469. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This study examines the de facto and potential role of markets in disaster anticipation and response. Disasters are defined as any decline in the value of economic resources beyond some socially determined threshold, which varies directly with space and time. In this framework the oil shocks of the 1970s and 1980, which imposed a new regime of relative prices and hence significant losses in the value of the pre-existing allocation of resources, qualify as a disaster. In the United States, government-imposed price ceilings and mandatory allocations delayed the necessary adjustment and added to the total costs of the shock; nor did they increase social

equity in terms of commonly accepted criteria. Free markets have played a major role in the demobilization and recovery following wars, which are disasters of massive proportions. Sociological evidence indicates that individuals rarely panic in the aftermath of disasters and usually respond effectively at a grass roots level; centrally dictated responses and external donations tend not to be sensitive to local conditions or desires. Markets are seen as an institutional supplement and magnifier of spontaneous individual and community adaptive behavior. Government can facilitate the contribution of markets by limiting its own role to coordination and procurement, rather than production, of goods and services obtainable from contestable markets. 41 refs.

2903 Environment, Health, and Safety

Refer also to citation(s) 2187, 2282, 2283, 2284, 2286, 2512, 2539, 2556, 2616, 2745, 2764, 2766, 2767, 2768, 2769, 2771, 2772, 2773, 2774, 3408, 3431, 3442, 3462, 3470, 3485, 3491, 3518, 3519, 3520, 3521, 3522, 3523, 3524, 3525, 3526, 3527, 3528, 3529, 3530, 3531, 3532, 3533, 3534, 3535, 3547, 3558, 3575, 3577, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3684, 3772, 3779

2594 (ORNL/FTR–3439) **[Emergency planning for technological and natural hazards]: Foreign trip report, October 1, 1989–October 15, 1989.** Sorensen, J.H. Oak Ridge National Lab., TN (USA). 27 Oct 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002660. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Information was collected on research being conducted in Great Britain on emergency planning for technological and natural hazards. Several recent accidents in England have raised questions about the level of preparedness. In addition, the Seveso directive on emergency planning for chemical facilities is being implemented. Overall research activities regarding emergency planning is not as well developed in England as it is in the United States. Data collected by British researchers complements that found on US disasters, and in some cases fills data gaps in the US. Modeling efforts on chemical exposure following industrial accidents are well developed and our modeling efforts can be improved based on the knowledge derived from the trip. 4 figs.

2595 (PB–89-236418/XAB) **EPA's (Environmental Protection Agency's) approach to pollution prevention.** Stephan, D.G.; Atcheson, J. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. Jun 1989. 8p. (EPA–600/J-89/004). Available from NTIS, PC A02/MF A01.

Pub. in Chemical Engineering Progress, 53-58(Jun 1989).

EPA's adoption of pollution prevention as the cornerstone of its future efforts on environmental protection is described as are the roles of the Pollution Prevention Office and the Waste Minimization Branch.

2596 (PB–89-870893/XAB) **Environmental impacts: Computer analysis. January 1970-September 1988 (Citations from the NTIS data base). Report for January 1970-September 1988.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 261p. Available from NTISPC N01/MF N01.

See also PB–89-870901.

This bibliography contains citations concerning the utilization of computerized methods in the analysis of environmental impacts related to a variety of human activities. Topics include descriptions and evaluations of specific simulation programs, site analyses, and the employment of computer equipment in environmental data analysis. Plume migration in water- and air-pollution studies, and the analysis of aquatic and terrestrial ecosystems are among the applications considered. (This updated bibliography contains 395 citations, none of which are new entries to the previous edition.)

2597 (PB–89-870901/XAB) **Environmental impacts: Computer analysis. October 1988-September 1989 (Citations from the NTIS data base). Report for October 1988-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 42p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868856. See also PB–89-870893.

This bibliography contains citations concerning the utilization of computerized methods in the analysis of environmental impacts related to a variety of human activities. Topics include descriptions and evaluations of specific simulation programs, site analyses, and the employment of computer equipment in environmental data analysis. Plume migration in water- and air-pollution studies, and the analysis of aquatic and terrestrial ecosystems are among the applications considered. (This updated bibliography contains 50 citations, all of which are new entries to the previous edition.)

2598 (PNL-SA–16875) **Integrated computer-based tools to facilitate environmental monitoring, assessment, and restoration.** Cowley, P.J.; Brown, J.C. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891053–8: 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?, Richland, WA (USA), 16-19 Oct 1989). Order Number DE90002732. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The vast amounts of scientific and technical data gathered during the process of environmental monitoring, assessment, and restoration make the effective application of computer-based tools essential. This paper describes how an integrated set of automated resources is being applied at the Hanford Site to effectively manage the data gathered during site characterization and monitoring and to provide an environment that facilitate analysis and assessment. The Hanford Environmental Information System (HEIS) has upgraded our previous monitoring and characterization capabilities and represents significant advances in our ability to manage, retrieve, and display data. An integrated data base, a geographic information system (that allows data to be displayed on a map), and support graphics allow the user to generate spatially related visualizations and perform data extractions. This allows the user to gain insight quickly and easily by obtaining a complete picture of the data of interest. HEIS also provides the capability to share the information with other software environments for further analysis and assessment. 3 figs.

2599 **Greenhouse gas emission coefficients from the energy system. Two methods to calculate national CO_2-e issions.** Okken, P.A.; Tiemersma, D.N. 24p. Netherlands Energy Research Foundation ECN, Petten (NL) (Oct 1989).

Two methods to calculate national CO_2-emissions, by using official energy statistics and CO_2-emission coefficients for fossil fuels, are described. In the first method (A) the national inland primary energy requirements are multiplied by the CO_2-emission coefficients, assuming all fossil fuels are combusted. In the second method (B) the fossil fuels used as chemical feedstocks (e.g. plastics) are subtracted from the national primary energy requirement, and the CO_2-emissions from registered combustion of feedstocks (e.g. combustion of plastic disposables) are added. In both methods (A and B) the fossil fuel consumption for international bunkers is excluded. Method A clearly overestimates CO_2-emissions because a major part of the petrochemical feedstocks are not combusted: e.g. plastics and bitumen are used as construction materials, plastic-waste is used as landfill. On the other hand method B underestimates CO_2-emissions due to unregistered combustion of petrochemical feedstocks. The actual Netherlands CO_2-emission in 1985 is estimated to be 149 +- 1 Mt CO_2. 2 figs., 26 refs., 12 tabs., 1

2904 Natural Resources

Refer also to citation(s) 3576

2600 (NEI-DK–179) **Report for the period 1 July 1988–30 June 1989 from the Mineral Resources Administration in Greenland.** Raastofforvaltningen for Groenland, Copenhagen (Denmark). 30 Aug 1989. 68p. (In Danish). Order Number DE90705938. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI.

In 1979 Home Rule was introduced in Greenland. In the same year and in relation to the revision of the law on Greenland's mineral resources a Joint Council specializing in this subject, was established. The establishment and administration of this Council is described in detail. For some years the Danish Government and the Home Rule have been negotiating on agreements regarding Greenland's raw materials, and these negotiations are elucidated closely.

The discovery of Cryolite in Greenland is touched upon. A very detailed list of projects, proposed, current and completed, and of applications from foreign firms wishing to make underground investigations to establish the extent of the mineral resources, is given.

2601 (PB–89-224984/XAB) **Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook.** Hohmann, K. Fish and Wildlife Service, Washington, DC (USA). 1989. 7p. (FISH/WILDLIFE-LEAFLT–13.2.2). Available from NTIS, PC A02/MF A01.

North America's wetland ecosystems are ailing. One symptom is the steady decline in waterfowl populations. The 1988 data show a record low count of northern pintails. The year's fall flight index for all ducks was 66 million, far off the 1987 count of 74 million. Accompanying this was the continued large-scale destruction of wetlands. Between the mid-1950's and 1975, about 9 million acres of wetlands in the lower 48 States were converted to other uses. Today, the United States continues to lose wetlands at the rate of about 450,000 acres annually. Canada's wetlands are also succumbing to development and agriculture. The plan is the first continental program to battle loss of waterfowl and wetlands. In both the United States and Canada, the North American Waterfowl Management Plan is implemented through joint ventures. These joint ventures are teams of Federal, State, and private organizations that work in six regions across the United States. In Canada, there are two regional (Prairie Habitat, Eastern Habitat) and two species-oriented (Arctic Goose and Black Duck) joint ventures.

2602 (PB–89-224992/XAB) **Migration of radio-marked whooping cranes from the Aransas-wood buffalo population: Patterns of habitat use, behavior, and survival. Technical report.** Howe, M.A. Fish and Wildlife Service, Washington, DC (USA). 1989. 40p. (FISH/WILDLIFE-TR–21). Available from NTIS, PC A03/MF A01.

Library of Congress catalog card no. 89-600146.

Use of migration stopovers by radio-marked whooping cranes (Grus americana) between Aransas National Wildlife Refuge, Texas, and central Saskatchewan was studied in fall 1981-83 and spring 1983-84 as part of a cooperative program with the Canadian Wildlife Service. Twenty-seven cranes were monitored for one or several seasons, including nine radio-marked birds and others that associated with them. Whooping cranes showed variations in their use of migration habitats, feeding primarily in a variety of croplands and roosting primarily in palustrine wetlands. More than 40% of the roosting wetlands were smaller than 0.5 ha. Although heavily vegetated wetlands were generally not used, family groups appeared to select more heavily vegetated wetlands than nonfamilies. Juveniles allocated 25% more time to foraging than did parents. Parents increased their foraging rate and showed less alert behavior in spring migration. Dissociation of parents and young occurred late in spring migration and after arrival on the breeding grounds.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 2622, 2689, 3320, 3604

2603 (ACERR–1989) **Alberta/Canada Energy Resources Fund annual review, 1987-88.** Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada). 1989. 40p. (In English and French). Available from Alberta Energy and National Resources, Information Centre, 9920-108 Street, Edmonton, Alberta, Canada K1A 0G1.

The Alberta/Canada Energy Resources Research Fund was created in 1976 between the governments of Alberta and Canada to promote and support the development and efficient use of Alberta's existing and potential energy resources to meet the province's and Canada's medium- and long-term energy needs; and to encourage the development of scientific and technical expertise in energy research, development and demonstration in Alberta. The program includes the production, transportation, conservation and utilization of both renewable and nonrenewable (fossil fuel) resources, generally excluding oil sands and heavy crude oil. This review highlights the research activities undertaken during the year. These include recovery of waste heat produced by the refrigeration system of a cattle-slaughtering and meta-packing operation, resulting in a payback period of only 15 months and substantial cost savings; installation of a heat recovery and water recycling system in two Calgary laundries, causing natural gas use to decline by up to 50%; the use of coal rather than natural gas as a fuel in steam operations in several oil sand/heavy oil regions of Alberta; and research programs at the Coal Research Centre at Devon, Alberta, the principal centre for coal research in Western Canada. A financial statement is included.

2604 (AD-A–210412/3/XAB) **Review of facility-technology options and their development status. Final report.** Windingland, L.M.; Frantzis, L.; Teagan, W.P.; Leary, K.J. Army Construction Engineering Research Lab., Champaign, IL (USA). Jun 1989. 102p. (CERL-TR-E–89/09). Available from NTIS, PC A06/MF A01.

This report reviews the status of new energy technologies which are potentially relevant to the Army's needs. It covers technologies having both short- and long-term potential that are being developed by various Government agencies and private firms. For each technology, this report: Describes the technology; Summarizes its status; Identifies its commercial availability; Explains the development programs and the funding organizations; Describes its major cost and performing issues; and Describes the possible Army applications.

2605 (CONF-890659–3) **Supporting independent inventors.** Bernard, M.J. III; Whalley, P. Argonne National Lab., IL (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 14. annual meeting and international symposium of the Technology Transfer Society; Oak Ridge, TN (USA); 13-16 Jun 1989. Order Number DE90002168. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Independent inventors contribute products to the marketplace despite the well-financed brain trusts at corporate, university, and federal R and D laboratories. But given the environment in which the basement/garage inventor labors, transferring a worthwhile invention into a commercial product is quite difficult. There is a growing effort by many state and local agencies and organizations to improve the inventor's working environment and begin to routinize the process of developing ideas and inventional of independent inventors into commercial products. 4 refs.

2606 (DOE/BP–1177) **Research projects in residential technology.** Paglin, C.; Reinhart, R. USDOE Bonneville Power Administration, Portland, OR (USA). Office of Energy Resources. Mar 1989. 17p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002852. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This booklet provides a brief description of both completed and ongoing research and development projects assigned to the Residential Technology Section. It describes the objective and results of each completed project along with a report title and contact person for each project for more information. For ongoing projects, the objective, the anticipated results and completion dated, and a contact person are provided.

2607 (DOE/BP–1211) **Research and Development report: Fiscal years 1987–1988.** USDOE Bonneville Power Administration, Portland, OR (USA). Office of the Senior Assistant Administrator for Power Facilities. Aug 1989. 77p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002857. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

With this edition, the research and development (R&D) Report goes to a biennial publication schedule and covers the R&D work of two fiscal years–1987 and 1988–at the Bonneville Power Administration (BPA). These pages summarize R&D projects in three program realms– Transmission, Resources, and Fish and Wildlife– to share information and results with customers, industry peers, and personnel within BPA. More detailed spotlights cover endeavors of particular value to the industry and its customers. We hope that this report will stimulate exchange of technical information and will help transfer the results of BPA research to practical applications throughout the region and beyond. For additional information, readers are encouraged to contact the individual project managers and to refer to the bibliography in the Information Resources section.

2608 (DOE/ER–0184/5) **Guide for the preparation of applications for the University Research Instrumentation Program, 1990.** USDOE Office of Energy Research, Washington, DC (USA). University and Industry Programs Div. [1989]. 38p. Sponsored by U.S. DOE Energy Research. Order Number DE90002688. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The University Research Instrumentation (URI) program has been developed as part of an interagency effort under the coordination of the Office of Science and Technology Policy to help alleviate the overall shortage of sophisticated state-of-the-art instruments required for advanced scientific and technical research at universities. The program was initiated in FY 1984 with a recommended funding level in the Energy and Water Development Appropriation Act of $4,000,000. The FY 1990 Congressional appropriation for this program is anticipated to be about $5,000,000.

2609 (LBL-PUB–630-Rev./10-89) **High school honors program, July 23–August 5, 1989: Revision, October 1989.** Lawrence Berkeley Lab., CA (USA). 1989. 69p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90002245. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The High School Honors Program brings together some of the top science students from the United States and several foreign countries. The two-week endeavor is designed to acquaint the students with the latest techniques and advances in the field of Life Sciences and the role of the national laboratories in today's research. Through lectures, laboratories, field trips and assignments, the students are exposed to the way in which research is accomplished at a national laboratory. Time is set aside to consider the social implications of science in an effort to have well-rounded leaders for the future. This report overviews this year's program.

2610 (ORNL/PPA–89/1) **ORNL [Oak Ridge National Laboratory] 89.** Anderson, T.D.; Appleton, B.R.; Jefferson, J.W.; Merriman, J.R.; Mynatt, F.R.; Richmond, C.R.; Rosenthal, M.W. Oak Ridge National Lab., TN (USA). 1989. 59p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002799. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

This is the inaugural issues of an annual publication about the Oak Ridge National Laboratory. Here you will find a brief overview of ORNL, a sampling of our recent research achievements, and a glimpse of the directions we want to take over the next 15 years. A major purpose of ornl 89 is to provide the staff with a sketch of the character and dynamics of the Laboratory.

2611 (PB–89-185763/XAB) **Hostile intelligence threat: US technology.** Whitman, D. Office of the Deputy Under Secretary of Defense for Policy, Washington, DC (USA). Nov 1988. 21p. (DOD–5200-1-PH-2). Available from NTIS, PC A03/MF A01.

This publication outlines the hostile intelligence threat to U.S. industry and Western technology, including the operational capabilities of hostile intelligence services and their scientific and technological (S&T) targets. Current intelligence strategies used against the United States are described and sources of information providing countermeasures guidance are listed. Points of contact for security and counterintelligence assistance are also included.

2612 (SAND–89-1832) **Energy technologies at Sandia National Laboratories: Past, Present, Future.** Sandia National Labs., Albuquerque, NM (USA). Aug 1989. 115p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC04-76DP00789. Order Number DE90001799. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

We at Sandia first became involved with developing energy technology when the nation initiated its push toward energy independence in the early 1970s. That involvement continues to be strong. In shaping Sandia's energy programs for the 1990s, we will build on our track record from the 70s and 80s, a record outlined in this publication. It contains reprints of three issues of Sandia's Lab News that were devoted to our non-nuclear energy programs. Together, they summarize the history, current activities, and future of Sandia's diverse energy concerns; hence my desire to see them in one volume. Written in the fall of 1988, the articles cover Sandia's extremely broad range of energy technologies – coal, oil and gas, geothermal, solar thermal, photovoltaics, wind, rechargeable batteries, and combustion.

2613 (STU-I–707-1988) **Evaluation of the contributions made by STU (National Swedish Board for Technical Development) to the sphere of energy. Summary and conclusions.** Granholm, A.; Liff, R. Swedish National Board for Technical Development, Stockholm (Sweden). Nov 1988. 93p. (In Swedish). Order Number DE90719394. Available from NTIS (US Sales Only), PC A05/MF A01.

The aim of this evaluation is to provide conditions for improving the quality of the organization. The results of the energy research program are presented. New methods of evaluation have been tested. The study consists of 5 points: - analysis of purposes, - survey of programs, - case studies, - organizational development, - conclusions. The project has taken one year to accomplish. (G.B.).

2906 Nuclear Energy

Refer also to citation(s) 2188, 2466, 2467, 2509, 2556, 2804, 4403

2614 (INIS-BR–1743) **Brazilian nuclear policy with respect to the public opinion.** Freitas Brandao Bittencourt, C. Escola de Comando e Estado-Maior do Exercito, Rio de Janeiro, RJ (Brazil). 1988. 67p. (In Portuguese). Order Number DE90608868. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Four decades of the Brazilian nuclear history have been analysed with special emphasis placed on government policy and its repercussion on public opinion. The implications of the new constitutional regulations which rule the issue are discussed. it is also studied the change in the nuclear program structure, enforced in August 1988. At different times, the government decisions on nuclear energy could be classified as miser, extravagant, dissimulated and frank, successively. Their aftermaths, which show little consistency with the expectations laid on them, have led to discredit by part of the society, which is controlled by a scientific - intellectual elite. However, recent successes are likely to reverse this trend, if the government explores them properly. (author).

2615 (PNL-SA–16907) **1988 changes to United States law regarding nuclear third party liability.** Cunningham, G.H. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8909123–1: Meeting of the International Nuclear Law Association, Tokyo (Japan), 25-28 Sep 1989). Order Number DE90001902. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Price-Anderson Amendments Act of 1988 has introduced sweeping changes into the nuclear third party liability regime in the United States. The basis principle that a single, assured source of funds for compensation of those injured by a nuclear incident, regardless of the party actually at fault, has been maintained. The amount of such funding has been increased tenfold, to more than $7 billion, with a commitment that even more will be made available by the Congress, if needed. The scope of compensable injury has been broadened to include precautionary evacuations. With respect to contractors carrying out the defense-related nuclear activities of the Government, the changes have been equally momentous. The ceiling on Government idemnification has risen to keep pace with the maximum amount of licensee liability. Provisions designed to provide greater incentive to adherence to all nuclear safety standards have been added, authorizing the imposition of substantial civil and criminal sanctions for violations.

2616 **Probabilistic risk assessment in the nuclear power industry.** Fullwood, R.R.; Hall, R.E. 318p. Pergamon Books Inc., Elmsford, NY (1988).

This book describes a number of the more important improvements in risk assessment methodology in the nuclear industry, developed over the last decade. It presents them in an instructive way so as to be suitable for those wishing to understand the techniques. The methodology of modern probabilistic risk assessment (PRA) is discussed in detail. This book is divided into six parts: Protecting the public health and safety; Mathematics; Safety aspects of light water nuclear power plants; PRA; 34 types of applications of PRA; Resources.

2617 **Nuclear power technical co-operation in the Republic of Korea.** Islam, M.M. (International Atomic Energy Agency, Vienna (Austria)); Fischer, J.; Calori, F. *International Atomic Energy Agency Bulletin (IAEA)*, 31(2): 41-44 (1989).

The Republic of Korea has an extensive nuclear programme involving power reactors, research reactors, and nuclear fuel cycle facilities. During 1988, nuclear power contributed 46.9% of the total electricity generated in the country. Figs.

2907 Transport and Storage

Refer also to citation(s) 2603

2618 (DOE/PE–0093) **Assessment of costs and benefits of flexible and alternative fuel use in the US transportation sector: Technical report three: Methanol production and transportation costs.** USDOE Assistant Secretary for Policy, Planning and Analysis, Washington, DC (USA). Office of Policy Integration. Nov 1989. 46p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002625. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Department of Energy (DOE) in 1988 undertook a comprehensive technical analysis of a flexible-fuel transportation system in the United States. To keep interested parties informed about the progress of the DOE Alternative Fuels Assessment, the Department periodically publishes reports dealing with particular aspects of this complex study. This report provides an analysis of the expected costs to produce methanol and of several related issues. 17 refs., 21 figs., 44 tabs.

2908 Waste Heat Utilization

Refer also to citation(s) 2603, 2777

2619 **Cogeneration- and Total Energy potentials at an alternative natural gas price policy and environmental policy in the Dutch National Energy Outlook scenarios.** (WKK- en TE-potentielen bij een alternatief gasprijs- en milieubeleid in de NEV-scenario's). Boonekamp, P.G.M.; Verhagen, L. 31p. Netherlands Energy Research Foundation ECN, Petten (NL) (Sep 1989). (In (In Dutch)).

By request of the Dutch Ministry of VROM (public health, planning and environment) the Energy Study Centre of the Netherlands Energy Research Foundation carried out new calculations with regard to the title subject. New developments in the Dutch energy and environmental policies made that necessary. For eight cases the results for large-scale industrial cogeneration capacity are presented, i.e. the future industrial steam demand with gas turbine-, combined steam and power generation-, total energy gas- and total energy coal-installations or with coal- or gas boilers. The same calculations are made for small-scale Total Energy capacities. Finally some conclusions are given with regard to the total cogeneration potential. 8 tabs.

2910 Conservation

Refer also to citation(s) 2603, 2627, 2661, 2670, 2689, 2694, 2697, 2711, 2712

2620 (CONF-8808273–Vol.7) **ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 7, Community and local government conservation programs.** American Council for an Energy-Efficient Economy, Washington, DC (USA). c Aug 1988. 121p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE27489. From ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988. Available from ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036.

These fifteen refereed papers and summary reports reflect a range of residential and commercial energy management tools and strategies. Presentations are organized under five session subheadings: Institutional Energy Management (governments and schools), Government/Utility Partnerships, Target Marketing Strategies, Energy Performance Contracting, and Integrated Multi-Agency Programs. The conference proceedings include eleven volumes of technical papers and project summaries (organized by panel topic) and an index volume. The refereed papers included in the proceedings were peer-reviewed and authors have incorporated comments from panel leaders and reviewers. In addition, conference participants receive a conference program volume which includes abstracts of the papers, posters, and workshops.

2621 (DOE/CE/64615–T2-Exec.Summ.) **Developmental state programm for institutional conservation: Executive summary: Final technical report, October 1, 1986–September 30, 1988.** New Mexico Energy and Minerals Dept., Santa Fe, NM (USA). 1989. 23p. DOE Contract FG01-86CE64615. Order Number DE89009245. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The New Mexico Energy, Minerals and Natural Resources Department (EMNRD) was established in 1978 as the state government agency responsible for the development and management of New Mexico's energy, mineral and natural resources. This document is the department's report on an innovative project initiated in 1986 entitled "Developmental State Programs for Institutional Conservation."

2622 (LBL–27289) **Policies and programs for promoting energy conservation in the residential sector: Lessons from five OECD [Organization for Economic Cooperation and Development] countries.** Wilson, D.; Schipper, L.; Tyler, S.; Bartlett, S. Lawrence Berkeley Lab., CA (USA). Jun 1989. 206p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002605. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

In this report we describe national residential energy conservation policies and programs in five countries. Within supply and demand contexts, we describe the governments' stated energy policies, the structure of and relationships among the various institutions responsible for establishing and implementing those policies, and the programs they developed. This information is presented country by country, in what we call "country reports." In addition, we refer to national residential energy conservation programs in the United States. The purpose of this is to establish the setting in which our work is expected to be used; the reader can use this information in order to make his/her own comparisons with the five countries. 112 refs., 9 figs., 26 tabs.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 2604, 2627, 2632

2623 (DOE/EIA–0202(89/4Q)) **Short-term energy outlook: Quarterly projections.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. Oct 1989. 58p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002872. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The Energy Information Administration (EIA) quarterly forecasts of short-term energy supply, demand, and prices are revised in January, April, July, and October for publication in the Short-Term Energy Outlook (Outlook). An annual supplement analyzes previous forecast errors, compares recent projections by other forecasters, and discusses current topics of the short-term energy markets (see Short-Term Energy Outlook: Annual Supplement, DOE/EIA-0202). The principal users of the Outlook are managers and energy analysts in private industry and government. The projections in this volume extend through the fourth quarter of 1990. The forecasts are produced using the Short-Term Integrated Forecasting System (STIFS). The STIFS model uses two principal driving variables: a macroeconomic forecast and world oil price assumptions. Macroeconomic forecasts produced by Data Resources, Inc. (DRI), are adjusted by EIA to reflect EIA assumptions about the world price of crude oil, energy product prices, and other assumptions which may affect the macroeconomic forecast. EIA's Oil Market Simulation Model is used to project world oil prices. (The EIA models are available on computer tape and diskette from the National Technical Information Service.) The three featured projections for petroleum supply and demand are based on low, middle, and high economic growth assumptions coupled, respectively, with high, middle, and low crude oil price trajectories. The discussion and tables in this

volume refer primarily to the middle, or base case, scenario and, unless otherwise noted, to the domestic situation. Table 7 summarizes the petroleum sensitivity cases and indicates the separate contributions to the alternative cases of price, macroeconomic conditions, and weather.

2624 (LBL–27131) **Least-cost planning in the utility sector: Progress and challenges: Volume 2, Technical appendix.** Goldman, C.A.; Hirst, E.; Krause, F.; Anderson, K.; Berry, L.; Eto, J.; Geller, H.; Harris, J.; Levine, M.; Meier, A.; Rosenfeld, A.; Sabo, C.; Vine, E.; Wiel, S.; Wodley, C. Lawrence Berkeley Lab., CA (USA). Jun 1989. 50p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002612. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is the technical appendix of an LBL/ORNL study that was commissioned by the Department of Energy to review recent progress in least-cost utility planning in the United States, entitled "Least-Cost Utility Planning in the Utility Sector: Progress and Challenges. This appendix contains the contributions of many authors on important topics related to integrated resource planning. The editors used this material as the basis for the study and formulation of recommendations regarding priorities for future work on least-cost planning. 44 refs., 3 tabs.

2625 (NEI-SE–44) **Energy in Sweden 1988.** Energy in Sweden. Statens Energiverk, Stockholm (Sweden). Jun 1988. 15p. Order Number DE90719396. Available from NTIS (US Sales Only), PC A03/MF A01.

Energy in Sweden.; The publication has got wrong ISSN-number. Should be ISSN-0282-7107.

Energy in Sweden 1988 is intended for politicians, administrators, businessmen, journalists, teachers and others who are interested in obtaining up-to-date problem oriented information The paper provides information about the energy situation- developments and forecasts concerning both energy use and energy supply, advances in energy research, current assessments of energy prices, the environmental impact of using different forms of energy etc. The total quantity of energy supplied in 1987, amounting to 455 TWh, of which almost one third was in the form of electricity was approximately the same as in 1970.

2626 (RISO-M–2798) **Simulation of the Italian energy system with the DESS-model.** Halsnaes, K.; Soerensen, H. Risoe National Lab., Roskilde (Denmark). Jun 1989. 69p. Order Number DE90718930. Available from NTIS (US Sales Only), PC A04/MF A01.

This report describes a simulation of the Italian energy system for the period 1980 to 2000 with the energy simulation model DESS (Detailed Energy Simulation System). The Italian model comprises a detailed database for the most important part of the energy demand and conversion system. This database is split into the following five parts: the building stock, district heating, power system, the process sector, and the transport sector. As a result of the simulation a total gross energy balance for Italy is generated. The actual simulation referred to in this report is made according to some main assumptions in the National Italian Energy Plan where nuclear power production is kept constant and all new constructed power plants are coal fired. (author) 28 tabs., 10 ills., 17 refs.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 2556, 3320

2627 (DOE/CH/10348–1, pp. 49-68) **The electric-utility industry perspective.** Yeager, K.E. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

This paper offers some thoughts on energy sector competition from the utility industry perspective. Electricity plays a central role in the nation's economy and is one of our productivity advantages in the ultimate global market competition. Changes in regulatory policy and underlying economics has substantially changed the business environment. Further changes are likely. About 3,200 independent organizations make up the utility industry and share a complex business environment. These organizations differ in many ways: in ownership form, size, capitalization, cost, structure, type and variety of services, markets, marketing efforts, type and composition of fuels used, degree of environmental constraints faced, and regulatory operating conditions. Response to an uncertain and competitive environment is taking two general forms of either bulk power producers or brokering and distribution of power produced by others. Some may pursue a mixed technology. With either strategy, reducing capital and O&M costs is an integral component. Competitiveness demands a strong technological response. Over 80% of total assets, over $500 billion, is invested in sophisticated generation, transmission, and distribution plants. The Electric Power Research Institute has a strong research program to provide new planning and management tools, and new technologies needed in a changing marketplace. Research initiatives are directed to; (1) controlling costs with, productivity improvements, developing next-generation power plants, and improving transmission and distribution system performance, and (2) enhancing markets with, better understanding of customer needs, and more productive use of electricity. Promising new and improved technologies are now available and under development to keep electric utilities vital and competitive.

2940 Fossil Fuels

Refer also to citation(s) 2124, 2136, 2137, 2139, 2144, 2149, 2599, 2603, 2627

2628 (DOE/EIA–0109(89/08)) **Petroleum supply monthly, August 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 27 Oct 1989. 127p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002595. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

This is one of a family of three publications produced by the Petroleum Supply Division within the Energy Information Administration (EIA) reflecting different levels of data timeliness and completeness. The other two publications are the Weekly Petroleum Status Report (WPSR) and the Petroleum Supply Annual (PSA). Data presented in the PSM describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 states and the District of Columbia). The reporting universe includes those petroleum sectors in "Primary Supply." Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States. Data presented in the PSM are divided into two sections (1) the Summary Statistics and (2) the Detailed Statistics.

2629 (DOE/EIA–0130(89/08)) **Natural gas monthly, August 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 31 Oct 1989. 171p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002592. Available from NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.

The NGM highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported.

2630 (DOE/EIA–0219(88)) **International energy annual, 1988.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 7 Nov 1989. 185p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002569. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The International Energy Annual presents current data and trends for production, consumption, stocks, imports, and exports of primary energy commodities in more than 190 countries, dependencies, and areas of special sovereignty. Also included are prices on crude oil and petroleum products in selected countries. This report is published to keep the public and other interested parties fully informed of primary energy supplied on a global basis. The data presented have been largely derived from published sources and from reports US Embassy personnel in foreign posts (refer to sources listed in Appendix D). The data have been converted to units of measurement and thermal values (Appendices A and B) familiar to the American public.

2631 (LBL–25674-Rev.) **The role of oil in electricity generation in five European countries: Past, present, and potential.** Hawk, D.V.; Schipper, L. Lawrence Berkeley Lab., CA (USA). Oct 1989. 49p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90003297. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The annual primary oil demand of five European countries — France, Germany, Italy, England & Wales, and Sweden — declined by approximately 25% between 1973 and 1986. Nearly one-third of this decline is the result of the phasing-out of oil for use in electricity generation. In 1973, oil was the first- or second-most important energy source for electricity generation in all of these countries — generating between 14% and 59% of electricity produced. By 1986, oil's share of electricity generation had declined to between 1.5% and 5.6% in all countries except Italy (39.4%), where oil is still being used for base-load generation. In England & Wales and Sweden, oil-based generation may soon increase above 1986 levels. In Sweden, oil-based generation will be used to bridge a supply gap that will result from the decommissioning of nuclear power plants in the absence of new generation capacity to replace them. Although oil-fired electricity generation may increase above 1986 levels in the near future in some countries, the maximum potential levels of oil-based generation calculated in this report will not be attained in any of the countries unless a major electricity-generation resource or technology suffers a severe, unforeseen disruption. In the absence of such a disruption, institutional barriers against dependence on oil will preclude the realization of the existing potential. Nonetheless, the hidden potential for oil use in the power sector, represented by the existing oil-fired capacity, must not be forgotten. As institutions and political agendas evolve, so too might attitudes regarding oil use.

2960 Electric Power

Refer also to citation(s) 2627, 2629, 2630, 2631, 2643, 2645

2632 (CONF-8909242–1) **Guidelines for a "good" integrated resource plan.** Hirst, E. Oak Ridge National Lab., TN (USA). 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From National Association of Regulatory Utility Commissioners conference; Charleston, SC (USA); 10-13 Sep 1989. Order Number DE90001642. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the past several years, more and more electric utilities have prepared long-term resource plans that integrate demand-side programs into the utility's mix of energy and capacity resources. Although several organizations have enumerated the number of states with laws or regulations requiring utilities to prepare such plans, no one has yet reviewed enough plans to assess utility progress in integrated-resource planning and to develop criteria for what constitutes a good plan. This paper offers initial guidelines, an early output from an ongoing project at Oak Ridge National Laboratory. 14 refs., 3 figs., 3 tabs.

2633 (CONF-8909242–2) **The practice of utility least-cost planning: A report on a study-in-progress.** Schweitzer, M. Oak Ridge National Lab., TN (USA). Sep 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From National Association of Regulatory Utility Commissioners conference; Charleston, SC (USA); 10-13 Sep 1989. Order Number DE90002489. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Oak Ridge National Laboratory (ORNL) has conducted a number of studies on the subject of utility least-cost planning in recent years. This paper presents the findings from two of these projects, one focusing on planning for uncertainty and the other examining the overall resource planning process. Altogether, resource plans were obtained from 29 utilities and three state agencies, selected on the basis of their reputation for competent planning. To date, about half of these plans have been reviewed in detail, and site visits have been made to four utilities and one public interest group active in this field. 15 refs., 3 figs.

2634 (DOE/EIA–0226(89/08)) **Electric power monthly, August 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 14 Nov 1989. 169p. Sponsored by U.S. DOE Management & Administration. Order Number DE90003093. Available from NTIS, PC A09/MF A01 - GPO - OSTI; GPO Dep.

The Electric Power Monthly (EPM) is prepared by the Electric Power Division; Office of Coal Nuclear, Electric and Alternate Fuels; Energy Information Administration (EIA); Department of Energy. The purpose of this publication is to provide energy decisionmakers with accurate and timely information. The EPM presents monthly summaries of electric utility statistics at the national, Census division, and State level for net generation, fuel consumption, fuel stocks, quantity and quality of fuel, cost of fuel, electricity sales, and retail prices of electricity. Data on net generation are also displayed at the North American Electric Reliability Council (NERC) region level. Additionally, company and plant level information are published in the EPM on capability of new plants, net generation, fuel consumption fuel stocks, quantity and quality fuel, and cost of fuel. 10 refs., 1 fig., 40 tabs.

2635 (LBL–27450) **Evaluation methods in competitive bidding for electric power: Volume 2, Technical appendix.** Kahn, E.P.; Goldman, C.A.; Stoft, S.; Berman, D. Lawrence Berkeley Lab., CA (USA). Jun 1989. 64p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC03-76SF00098. Order Number DE90003298. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Private suppliers of electricity that participate in competitive auctions must specify a multi-year price trajectory. It may be desirable for some bidders to propose prices that exceed the buyer's estimate of value in the short run, but still offer substantial long run benefits. Prices of this kind are called "front loaded." From the buyer's perspective, bids which are front loaded are somewhat undesirable. They impose upon the buyer the risk that the long run benefits will not materialize if the supplier terminates delivery pre-maturely. In this appendix, we develop a model to evaluate front-loaded bids, which we call the implicit loan (IL) method. In this model, we view front-loading to be a loan from buyer to seller. This notion, which has been suggested informally in the past, is formalized and made the basis for an explicit analytic evaluation method.

2636 (LBL–27748) **Key issues in developing demand-side bidding programs.** Goldman, C.A.; Hirst, E. Lawrence Berkeley Lab., CA (USA). Sep 1989. 14p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-8911105–1: ECNE national conference on demand-side management, Boston, MA (USA), 16-17 Nov 1989). Order Number DE90002455. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Several utilities in New England have conducted pilot bidding programs for demand-side resources, while integrated bidding processes, which include DSM resources, are currently being planned or implemented by utilities in New York, New Jersey, and Washington. In this study, we examine several resource planning and program implementation issues that are raised by competitive bidding programs for DSM resources: the choice of combined or separate bidding for demand and supply resources, the criteria used to rank and select projects proposed by bidders, the value of DSM resources, the role of non-price factors, and issues that arise in measuring the impact of DSM programs. We compare the bid evaluation systems used by four utilities that are conducting integrated bidding programs and examine the nominal weights assigned to various features (e.g., price, project status/viability, system optimization, environmental factors) by each utility. We conclude that bidding may have a limited role in a utility's overall DSM

strategy because bidding mechanisms are inappropriate for various types of programs and because of the relative immaturity of the energy services industry. 8 refs., 2 figs.

2637 (LiU-Tek-Lic–1989-13) **MINTOP industrial load management system.** Linkoeping studies in science and technology. (no. 173). Karlsson, B. Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering. Mar 1989. 158p. (In Swedish). Order Number DE90719413. Available from NTIS (US Sales Only), PC A08/MF A01.

Linkoeping studies in science and technology.; (no. 173).

In the near future the demand for electric energy and power in Sweden will be larger than the supply. The reason for this is, among other things, the planned nuclear phase-out. Therefore, an important measure will be to adapt the demand to the production capacity. The report describes what can be accomplished to adapt the industrial needs to the supply of electric power and energy, by means of a so-called industrial load management. This paper presents a newly developed system called MINTOP which can be used for performing load management measures in the industry. The system is based on personal computers, and communicates through a two-wired link by means of simple measurement/controlling modules which are placed near the objects that are being supervised or controlled. The system contains information about the current electric tariff which means that the control will be in an optimal way for the customer. Furthermore, the system can be used for inter-company debit, and in this way it provides a more adequate distribution of the industrial power- and energy costs. In the report, results from two load management installations, carried out at companies in the foundry industry, are presented. The pay back period for the two systems is, in each case respectively, about one year with an annual saving of SEK 200000-300000, based on the power tariffs for 1989. (author) (With 93 figures and 4 tables).

2638 (NEI-SE–43) **Electricity supply in Sweden 1988.** KRAFTSAM, Stockholm (Sweden). 1989. 30p. (In Swedish). Order Number DE90719395. Available from NTIS (US Sales Only), PC A03/MF A01.

This survey is produced by Kraftsam which is a joint organization of electric power producers constituted by the Swedish State Power Board and the Swedish Power Association. The summary includes total energy consumption, electricity consumption electric energy balance, load variations and power balance. Hydro power and nuclear power production is presented. Conventional thermal power and new production plants are dealt with and joint operation of interconnected power network is described.

2639 (NERC–90002691) **1989 reliability assessment: The future of bulk electric system reliability in North America, 1989–1998.** North American Electric Reliability Council, Princeton, NJ (USA). c Sep 1989. 88p. Available from North American Electric Reliability Council, 101 College Road East, Princeton, NJ 08540-6601.

A reliable supply of electricity is essential to the economic well-being and security of the United States and Canada. While aggregate utility plans will support the forecast growth in peak demand, this report identifies a widespread trend of actual peak demands consistently exceeding forecasts. If this trend continues, supply deficiencies are likely by the early 1990s in the eastern half of the United States and Canada. Several geographic areas are also identified where electric system reliability is at serious risk. Emergency operating measures, including controlled interruptions of customers' supply, will become more widespread in these areas. Key issues and threats to reliability discussed in the report are: economy versus reliability; disincentives; use of transmission systems; environmental policy; and non-utility generation.

2640 (PB–89-218754/XAB) **Dynamic cooperative electricity exchange in a power pool. Research report.** Ruusunen, J.; Ehtamo, H.; Haemaelaeinen, R.P. Helsinki Univ. of Technology, Espoo (Finland). Systems Analysis Lab. Apr 1989. 34p. Available from NTIS, PC EE03/MF A01.

A new approach to design the transaction agreement in an electric power pool is proposed. The electricity exchange takes place over a fixed time interval in a stochastic environment. No monetary payments between the utilities take place. The contract definition problem is approached from the point of cooperative game theory. In each period the contract is adjusted such that fair division of the cost savings is obtained.

2641 (SV–2000-352-2) **Industrial load management at Vaargaarda.** Bjoerk, C.; Bjarne, E. Swedish State Power Board, Vaellingby (Sweden); Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering. 30 Dec 1987. 84p. (In Swedish). (LITH-IKP-R–507). Order Number DE90719412. Available from NTIS (US Sales Only), PC A05.

In connection with the energy mapping and total power consumption measurements done at Vaargaarda industries, a study of the possibilities of industrial load management was carried out. Some industries outside Vaargaarda were included as well. The report contains an account of the electric energy and power demands of all companies in the study, their highest loads, and to what extent the possibilities of load management have been identified. Three different estimates of potential are presented. 1. Possible power reduction from technical point of view. 2. Today economically justified load management measures. 3. Likely steps taken by the companies (with or without backing from the State Power Board). The possible reduction from technical point of view lies between 2 to 3 MW (of a total subscribed power of not quite 6 MW). The other potentials are lower. The report presents a proposal for further actions and an attempted power and energy prognosis for the Vaargaarda industries. Regarding the remaining industries i.a. the result of simulations for a wire mill is presented. A reduction of the maximum power consumption with 25% would be possible.

2642 **Danish electricity supply. Statistics 1987.** (Dansk elforsyning. Statistik 1987.). 48p. Danish Association of Electricity Supply Undertakings, Lyngby (1988). (In Danish).

Published annually.

The Danish Association of Electricity Supply Undertakings each year issues the statistical yearbook "Danish Electricity Supply." By the means of brief text, figures, and tables, a description is given of the electric supply sector. The topics that are treated are production and consumption of electric power, production of heat, fuel consumption, the power plants and transmission system, and economy and prices of electric power. Each year a specific topic is treated in a supplementary article. (In)

2980 Consumption and Utilization

Refer also to citation(s) 2125, 2187, 2628, 2629, 2630, 2634, 2672

2643 (DOE/BP–1223) **Electricity use in the Pacific Northwest: Utility historical sales by sector, 1988 and preceding years.** USDOE Bonneville Power Administration, Portland, OR (USA). Sep 1989. 167p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002856. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Electricity Use in the Pacific Northwest: Utility Historical Sales by Sector, 1988 & Preceding Years is intended to enable detailed examination of annual regional electricity consumption. It provides electricity consumption statistics covering the time period 1970–1988 and also provides observations based on statistics covering the 1983–1988 time period. This report also officially releases the compilation of regional 1988 consumer sector sales data by the Bonneville Power Administration. The electricity use report is the only information source which provides data obtained from each utility in the region based on the amount of electricity they sell to consumers annually. Data is provided on each consumer sector: residential, commercial, industrial, direct-service industrial, and irrigation. Other reports typically examine electricity consumption trends by all utilities or by utility groups such as private and public utilities and do not include sector breakdowns.

2644 (DOE/PE–0092) **Energy conservation trends understanding the factors that affect conservation gains in the US economy.** USDOE Office of Policy, Planning and Analysis, Washington, DC (USA). Sep 1989. 40p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002648. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report presents the results of an updated analysis of energy-conservation trends conducted by the Department of Energy (DOE).

The purpose of the analysis was to document and explain the conservation gains that have been achieved and to estimate the effect of lower energy prices on additional gains that are likely to occur. The results provided the basis for evaluating conservation's past and future role in an energy policy context. The results presented in this report cover the period from 1972 to 1986 retrospectively, the recent experience from 1986 to 1989, and the future through 1995. Changes in energy-use and -efficiency patterns are examined for the US economy as a whole, for each end-use sector – residential, commercial, industrial, and transportation – and in comparison to trends in other industrialized countries.

2645 (EPRI-CU–6546) **1988 survey of residential-sector demand-side management programs: Final report.** Blevins, R.P.; Miller, B.A. Electric Power Research Inst., Palo Alto, CA (USA); Battelle Columbus Div., Mount Pleasant, PA (USA). c Oct 1989. 351p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The residential sector presents a wealth of demand-side management (DSM) opportunities for electric utilities. This report, which provides the results of a survey that identified and collected descriptive information on residential-sector DSM activities, can help utilities tap these opportunities. The survey provides summary information on 1022 separate residential programs conducted by 485 electric utilities. These programs, which reflect a diversity of utility objectives, technological focuses, incentive structures, and market implementation techniques, offer valuable sources of reference to utility planners. 35 figs., 45 tabs.

2646 (LBL–22642) **Residential energy demand in the six OCED countries: Historic trends and future directions.** Ketoff, A.; Bartlett, S.; Hawk, D.; Meyers, S. Lawrence Berkeley Lab., CA (USA). Jul 1987. 53p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002610. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report describes trends in residential energy consumption for the six largest OECD countries: the United States, France, Germany, Italy, Japan, and the United Kingdom. The focus is on how and why the demand for the different fuels – oil, gas, solids, and electricity – has been changing, and where the trends are leading residential energy use. 29 refs., 35 figs., 9 tabs.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 2273, 2299

2647 (ETSU-GEN–2006-P2) **Electricity producing renewable energy technologies common costing methodology. V. 2.** Y-ARD Ltd., Glasgow (UK); Department of Energy, London (UK); UKAEA Harwell Lab. (UK). Energy Technology Div. 1989. 99p. (YM–5501). Order Number DE90722761. Available from NTIS (US Sales Only), PC A05.

This initial study has been mainly occupied in examining prime sources of costing data in reports concerning the future development of renewable energy technologies in the United Kingdom. The level of detail, major assumptions and quality of the data, have been examined with a view to: (a) assessing the feasibility of developing cost estimation relationships;(b) identifying areas of both commonality and divergence between different technologies; and (c) presenting an initial cost comparison based on current data. The study has been limited to the following technologies: (i) horizontal axis aerogenerators, both onshore and offshore, rated in excess of one megawatt; (ii) wave energy devices, concentrating on the Edinburgh/Salter Duck and SEA Circular Clam; (iii) tidal power, concentrating on the Cardiff/Weston Severn barrage and some smaller schemes, and (iv) Geothermal Hot Dry Rocks, Organic Rankine Cycle. The conclusion of the study is that there is insufficient detail available in the data to develop a common costing methodology for these technologies at present. A considerable amount of work needs to be done before the Department of Energy can have any confidence when comparing the costs of these schemes. (UK).

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

2648 (DOE/PC/79680–T2) **Computer controlled MHD power consolidation and pulse-generation system: Technical progress report, October 1988–March 1989.** Johnson, R.; Marcotte, K.; Donnelly, M. Montana State Univ., Bozeman, MT (USA). Dept. of Electrical Engineering. [1989]. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79680. (ERL–290666-1). Order Number DE90001224. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The major goal of this research project is to establish the feasibility of a power conversion technology which will permit the direct synthesis of computer programmable pulse power. Feasibility will be established by demonstration of direct synthesis of commercial frequency power by means of computer control. The power input to the conversion system is assumed to be a MHD Faraday connected generator which may be viewed as a multi-terminal d.c. source. This consolidation/inversion process is referred to subsequently as Pulse-Amplitude-Synthesis-and-Control (PASC). A secondary goal is to deliver a controller subsystem consisting of a computer, software, and computer interface board which can serve as one of the building blocks for a possible phase II prototype system. This report contains discussions on the following areas: description of test transformer configurations for preliminary testing of the PASC power supply and computer control subsystems; results of test transformer testing; conclusions from preliminary testing results and new PASC configuration; control algorithms and data acquisition; feasibility demonstration testing. 16 figs.

2649 (DOE/PC/90274–T6) **MHD [Magnetohydrodynamics] Integrated Topping Cycle Project: Fourth quarterly technical progress report, May 1, 1988–July 31, 1988.** TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div. Feb 1989. 143p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC90274. (MHD-ITC–89-012). Order Number DE90002868. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The scope of work covered by this quarterly report encompasses primarily 50 MW_t power train data analysis and design support engineering for the prototypical hardware. Analysis of the 50 MW_t power train data continued to focus on investigation of the causes of the observed "power shortfall." Slag layer leakage and incomplete combustion effects were evaluated and channel analyses were performed to match the experimental data to theoretical predictions. Three major design support activities for the prototypical combustor are underway. Design confirmation tests of the 50 MW_t combustor were conducted at TRW to investigate the effects of prototypical configurations on combustor performance. Tests were also conducted at the 20 MW_t scale, utilizing an ash-injected combustor coupled to a CFC second stage to evaluate power output as a function of operating conditions and hardware configurations. Testing of the one-third scale combustor cold flow model continued, with emphasis on evaluating mixing performance in the exit and second stage. Prototypical combustor design activities focused on design requirements development, materials studies, and design configuration analyses. Both the materials studies and configuration analyses identified new and potentially better approaches to the prototypical combustor design. 78 figs.

3004 Thermionic Converters

2650 (UCID–21775-Vol.1) **Safety evaluation report for Galileo: Volume 1.** Joyce, J.P.; Gray, L.B.; Huff, D.A.; Ullian, L.J.; Kaisler, K.L.; Benz, F.J.; Brown, R.H.; Channell, D.B.; Fletcher, R.F.; Marshall, J.W.; Parker, L.C.; Reynolds, J.R.; Seabourn, C.M.; Thornton, M.A.; Wilhite, A.W.; Ailor, W.H. III; Baker, R.L.; Blaylocck,Lawrence Livermore National Lab., CA (USA); Interagency Nuclear Safety Review Panel (USA). Sep 1989. 94p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (INSRP–89-01-Vol.1). Order Number DE90003086. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Two General Purpose Heat Source Radioisotope Thermoelectric Generators (GPHS RTGs) provide the prime source of electric power for the spacecraft on the Galileo mission. In addition, 120 Light-Weight Radioisotope Heater Units (LWRHUs) provide heat for numerous spacecraft components. The use of radioactive material in RTGs and LWRHUs for the Galileo mission necessitates evaluation of the radiological risks. This Safety Evaluation Report presents the results of the evaluation performed by the Interagency Nuclear Safety Review Panel (INSRP) and its subpanels. Source material consulted for this evaluation included the Galileo Program Office Final Safety Analysis Report, safety test results, and launch vehicle and component historical data. In addition, independent analyses were conducted by INSRP and its subpanels. 20 refs., 17 figs., 11 tabs.

2651 (UCID–21775-Vol.2) **Interagency Nuclear Safety Review Panel: Safety evaluation report for Galileo: Volume 2.** Joyce, J.P.; Gray, L.B.; Huff, D.A.; Ullian, L.J.; Kaisler, K.L.; Benz, F.J.; Brown, R.H.; Channell, D.B.; Fletcher, R.F.; Marshall, J.W.; Parker, L.C.; Reynolds, J.R.; Seabourn, C.M.; Thornton, M.A.; Wilhite, A.W.; Ailor, W.H. III; Baker, R.L.; Blaylock, Lawrence Livermore National Lab., CA (USA); Interagency Nuclear Safety Review Panel (USA). Sep 1989. 112p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (INSRP–89-01-Vol.2). Order Number DE90003087. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report provides a brief overview of the various activities and decisions that were made by the Interagency Nuclear Safety Review Panel (INSRP) coordinators during the development of the Safety Evaluation Report for the Galileo mission. Each of the subpanels has generated a report describing its activities and the results of its portion of the Galileo evaluation. These reports should be reviewed for more indepth understanding of the subpanel activities. To bridge the gap between the subpanel reports and the Safety Evaluation Report, i.e., the assure continuity, this report summarizes the considerations and decisions made by the INSRP Coordinators at various points during the evaluation process. In particular, this report identifies the specific changes made to the Launch Accident Scenario Evaluation Program Version 2 (LASEP2) and EMERGE computer models used by the Department of Energy (DOE) in the development of Volumes II and III of the Galileo Final Safety Analysis Report and by INSRP in the development of the Safety Evaluation Report. In addition, this report documents decisions made concerning how to best present results obtained from the INSRP evaluation. 8 refs., 2 tabs.

2652 **Nuclear electric propulsion for near-term space missions.** Asbell-Clarke, J.E.; Houts, M.G.; Keaton, P.W. pp. 1363 of Engineering, construction, and operations in space; Proceedings of the Space '88 Conference, Albuquerque, NM, Aug. 29-31, 1988. Johnson, S.W.; Wetzel, J.P. American Society of Civil Engineers, New York, NY (US) (1988). (CONF-880843–: SPACE '88: engineering construction and operations in space, Albuquerque, NM (USA), 29-31 Aug 1988).

Potential uses of nuclear electric propulsion (NEP) for earth-orbit, lunar, and Martian missions are analyzed. NEP systems allow a higher payload mass fraction than chemical systems. NEP systems also allow a reduction in mission duration for interplanetary missions. The NEP reactor can be used to power the payload when the propulsion subsystem is shutdown. NEP systems may also reduce the total number of earth launches required to deliver a payload.

3005 Fuel Cells

Refer also to citation(s) 2578, 2758

2653 (AD-A–210630/0/XAB) **Evaluation of fuel-cell technology for Coast Guard applications. Final report.** Barrett, T.J. Coast Guard, Washington, DC (USA). Office of Research and Development. Oct 1988. 20p. (USCG-D–08-89). Available from NTIS, PC A03/MF A01.

Recent proposals and the literature show promise of fuel cells being commercially available in the next decade. We searched the literature to determine the current state of fuel-cell technology, to determine if fuel cells can be used by the U.S. Coast Guard, and to make proposals for possible research and development efforts by the Coast Guard. Alkaline and phosphoric acid fuel cell technologies are now technically capable of full scale commercial production. Molten-carbonate and solid-oxide fuel-cell technologies should be commercially produced within the next decade. Phosphoric Acid Fuel Cell (PAFC) technology is the most promising for Coast Guard use. However, there is no operational need for fuel cells at present and high capital costs and low-energy prices make them economically noncompetitive. We suggest three areas of R&D to prepare for changes in operational needs or energy economics. They are: operation of a 200-kW PAFC cogeneration plant to gain fuel-cell experience; development of low-maintenance/high availability PAFC system for remote power; and development of fuel cells for or aircraft propulsion in case there is a strategic crisis in petroleum-distillate supplies.

2654 (CONF-891113–5) **Electrode development in monolithic solid oxide fuel cells.** Dees, D.W.; Balachandran, Uthamalingam; Dorris, S.E.; Heiberger, J.J.; McPheeters, C.C.; Picciolo, J.J. Argonne National Lab., IL (USA). 1989. 7p. Sponsored by U.S. Department of Defense. DOE Contract W-31109-ENG-38. From American Institute of Chemical Engineers annual meeting; San Francisco, CA (USA); 5-10 Nov 1989. Order Number DE90001910. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The interfacial resistance of thin three-layer ceramic solid oxide fuel cell composites was studied at 100°C using AC impedance techniques. The anode interfacial resistance was found to increase dramatically when the H_2O content decreased below 0.03 atm in a H_2/H_2O fuel system. A similar effect was also observed for the CO/CO_2 fuel system. Increases in the anode interfacial resistance were also observed in the presence of H_2S. Significant decreases in the anode interfacial resistance were accomplished by tailoring the electrode's microstructure.

2655 (CONF-8910107–2) **Interfacial effects in monolithic solid oxide fuel cells.** Dees, D.W.; Balachandran, U.; Dorris, S.E.; Heiberger, J.J.; McPheeters, C.C.; Picciolo, J.J. Argonne National Lab., IL (USA). [1989]. 6p. Sponsored by U.S. Department of Defense. ARPA4850. From Electrochemical Society fall meeting; Hollywood, FL (USA); 15-20 Oct 1989. Order Number DE90001914. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The interfacial resistance of thin three-layer ceramic solid oxide fuel cell composites was studied at 1000° using ac impedance techniques. The anode interfacial resistance was found to increase dramatically when the H_2O content decreased below 0.03 atm in a H_2/H_2O fuel system. Increases in the anode interfacial resistance were also observed in the presence of H_2S. Significant decreases in the anode interfacial resistance were accomplished by tailoring the electrode's microstructure. 4 refs., 4 figs.

2656 (CRIE-T–87066) **Development of high-efficiency molten carbonate fuel cell. Evaluation of stack performance and clarification of degradation mechanism at high fuel utilization.** Watanabe, Takao; Mugikura, Yoshihior; Izaki, Yoshiyuki; Matsuyama, Toshiya; Kasai, Hidekazu; Sato, Seiji. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Oct 1988. 38p. (In Japanese). Order Number DE89901266. Available from NTIS (US Sales Only), PC A03/MF A01.

The stack performance of a molten carbonate fuel cell operated under high fuel utilization and high efficiency was evaluated. A 1kW class stack composed of 10 cells was operated for 1,700 hours gradually increasing the fuel utilization rate. As a measure to increase the utilization rate, continuous power generation under the simulate conditions of anode recycle was conducted, and it went on without a hitch. When the supplied fuel flow amount was reduced at the first stage of operation and the utilization rate was raised to 70%; the performance of four cells at the center of the stack greatly changed, and the electric potential was decreased and reversed to minus in the end. As a result of the recall test by a single cell, it was found that the partial change in the anode structure at the starting made the gas diffusion in the electrode uneven, this brought about the increase of anode overvoltage, and that was the cause of a series of performance changes. The process is as follows: the consumption of absorbed H_2 due to the shortage of fuel gas, the transition of anode Ni to oxide reaction, the increase of overvoltage,

decomposition of CO_3 at anode, and the appearance of CO_2 and O_2 generated by the decomposition at the cathodic exhaust gas side. It is necessary to optimize the parts, the manufacture and the starting procedure. 4 refs., 21 figs., 5 tab.

2657 (DOE/MC/25009–2752) **Effects of coal-derived trace species on the performance of molten carbonate fuel cells: Topical report (Progress report No. 4).** Pigeaud, A. Energy Research Corp., Danbury, CT (USA). Jan 1989. 29p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-88MC25009. Order Number DE90002826. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The primary objective of this study is to assess the overall combined effect of coal-derived gas-phase trace contaminants. The species will be simultaneously present in fuel gas at concentrations near the single contaminant tolerance level found for the MCFC. The species will include, but are not limited to mercury, tin lead, selenium, arsenic, and zinc in the presence of ammonia (NH_3), hydrogen sulfide (H_2S) and halide (HCl). To accomplish this, the contractor will provide: (1) comprehensive reports of the data obtained and briefings presenting our current understanding of the interaction mechanisms and various products formed, (2) an updated list of MCFC tolerances for trace species when tested in combination in coal-gas mixtures of at least seven contaminants such as might exist in fuel from a typical entrained- or fluidized-bed gasifier, and (3) a mathematical model capable of predicting the effects of combinations of trace species on performance and endurance of the MCFC. 39 refs., 1 fig., 3 tabs.

2658 (EGG-EP–8581) **An approach for testing fuel-cell/battery hybrid power sources for bus applications.** EG and G Idaho, Inc., Idaho Falls, ID (USA); U.S. Fuel Cells, Inc. (USA). 25 May 1989. 48p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE90002090. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The principal objectives of this report are: to describe an approach and outline general procedures for safe operation and testing of fuel cell/battery hybrid power sources, to discuss likely criteria for evaluating the system performance and relative merits of such power sources in a transportation application, and to describe the expected configuration and operation of the specific power systems now under development for the Department of Energy (DOE) sponsored transit bus program. 7 figs., 2 tabs.

2659 (PNL-SA–17036) **Solid oxide fuel cells electrodes based on In_2O_3-$PRrO_{1.83}$-ZrO_2.** Bates, J.L.; Weber, W.J.; Griffin, C.W. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC06-76RL01830. (CONF-8910107–3: Electrochemical Society fall meeting, Hollywood, FL (USA), 15-20 Oct 1989). Order Number DE90002666. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Oxides based on In_2O_3-$PrO_{1.83}$-ZrO_2 and having high electrical conductivity were developed as cathode materials for solid oxide fuel cells (SOFCs). A ternary phase diagram developed at 1823 K relates the electrical, thermal and electrochemical properties to compositions and structures of the material. The bcc In_2O_3 solid solution containing ZrO_2 and PrO_2 exhibits the highest electrical conductivity. Two-phase fcc-bcc structures provide high electrical conductivity with mixed ionic-electronic conduction, thermal expansion characteristics and fabricability compatible with other SOFC materials. The oxides are thermally stable in air to 1473 K, but are easily reduced at 1273 K. Electrochemical testing of an fcc-bcc composition with an externally applied current showed some densification of interface and exsolution of In_2O_3 at the cathode-electrolyte interface. 11 figs., 10 figs.

3008 Miscellaneous Converters

2660 (AD-A–210232/5/XAB) **Electrothermal guns – a theoretical investigation of factors for optimal performance. Technical report.** Oberle, W. Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab. Jun 1989. 59p. (BRL-TR–2999). Available from NTIS, PC A04/MF A01.

The electrothermal (ET) gun or electrothermal accelerator is an advanced propulsion concept in which an electrically generated high pressure and temperature plasma interacts with a carefully chosen working fluid to produce the necessary gases to accelerate the projectile. In theory, the combustion process is completely controlled by the electrical power input used to generate and sustain the plasma. Constant breech pressure and resulting optimal velocity should be obtainable by tailoring the power input for a given working fluid. Selecting working fluids which result in low molecular weight gases reduces the energy expended in accelerating the gases. This report, using an appropriately modified interior ballistic code, investigates several aspects of the electrothermal gun process. Conditions required of the electrical input and working fluid necessary to achieve the ideal constant breech pressure and optimal velocity are considered. The sensitivity of ballistic performance and gas temperature for the electrothermal process is determined for perturbations in several factors felt to be critical to ET performance. Differences arising from using non-energetic (endothermic) or energetic (exothermic) working fluid are addressed. Results of the computer simulations indicate that an ET gun can out-perform conventional solid-propulsion technology. The simulations indicate that the electrical power input required to drive the constant breech pressure is feasible. One of the critical factors in ET gun performance is reproducible plasma/working-fluid interaction, impacting not only projectile velocity and pressure profiles, but more significantly, gas temperature.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

Refer also to citation(s) 2641

3201 Buildings

Refer also to citation(s) 2145, 2334, 2338, 2342, 2343, 2606, 2620, 2621, 2622, 2646, 2731, 3412, 3413, 3448, 3487

2661 (AD-A–210826/4/XAB) **Three-dimensional modeling of heat transfer from slab floors. Final report.** Bahnfleth, W.P. Army Construction Engineering Research Lab., Champaign, IL (USA). Jul 1989. 213p. (CERL-TM-E–89/11). Available from NTIS, PC A10/MF A01.

Earth-coupled heat-transfer processes have been recognized in recent years as a potential source of significant energy savings in both conventional and earth-sheltered designs, Because of the complexity of the building/soil/atmosphere interaction, however, important aspects of earth-coupled heat transfer are not well understood. There is a particular lack of three-dimensional foundation heat-loss data. In this study, a detailed three-dimensional finite-difference model of a slab floor was used to generate 93 annual simulations in parametric groups focusing on effects of size and shape, soil properties, boundary conditions, climate, insulation, and building shadow. These results indicate that soil thermal conductivity, ground surface conditions, foundation design, and floor shape/size are essential elements of a general change in heat-transfer rate.

2662 (BRE-IP–10/89) **Building management systems: user experiences.** John, R.W.; Fargus, R.S.; Smith, G.P. Building Research Establishment, Watford (UK). Jun 1989. 4p. Order Number DE90722671. Available from NTIS (US Sales Only), PC A02/MF A01.

BRE has reviewed 42 building management system (bms) sites to assess users' reactions to their systems' performance. User experiences offer a valuable insight into the benefits and problems associated with bms. Lessons from the work can aid the selection, specification, installation and long-term operation of bms; and will be of interest to building managers and building services engineers. The work has illustrated: (1) the benefits attributed by users to the use of a bms, typically energy savings of between 10 and 20%, improved management (such as reduced maintenance/more efficient use of manpower), and an improvement in comfort; (2) the significant improvements that have occurred in the performance of bms

systems between those studied in 1984 and those studied during 1987; (3) the problem areas most commonly encountered by users, eg the man-machine interface; and (4) the importance of carefully selecting and specifying the bms to match the operating environment and, in particular, the skills of bms users. (author).

2663 (BRE-IP–11/89) **Space and hot water heating: energy-efficiency in large gas-fired systems.** Trim, M.J.B. Building Research Establishment, Watford (UK). Jun 1989. 4p. Order Number DE90722672. Available from NTIS (US Sales Only), PC A02/MF A01.

In many older, residential housing schemes, space and domestic hot water heating are provided by over-sized, gas fired heating plants. In such systems there is scope for improving operating performance, particularly to reduce energy use and plant maintenance. Drawing on a monitoring programme in sheltered housing, this paper describes for designers, installers and operators some simple energy-efficient measures that can be applied to the design of centralised heating plants for residential accommodation. (author).

2664 (CSTB-PC–661) **Preliminary study to a demonstration building climatic design program in the Ivory Coast.** Grelat, A. Centre Experimental de Recherches et d'Etudes du Batiment et de Travaux Publics, 75 - Paris (France). 1987. 319p. (In French). Order Number DE89908088. Available from NTIS (US Sales Only), PC A14/MF A01.

The two main objectives of this study are: the development of recommendations concerning the thermal design of inexpensive-type residential building in tropical climates (wet and dry), based on simulation results; the experimental study and the thermal optimization of a pilot climatic building estate (1000 housings) in Abidjan (Ivory Coast): thermal comfort, ventilation, building thermal behaviour. A sociological study on in-house occupation is also presented.

2665 (DOE/BP–1193) **Radon monitoring results from BPA's Residential Weatherization Program: Report No. 10.** US-DOE Bonneville Power Administration, Portland, OR (USA). Feb 1989. 33p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002855. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This Standard Review Plan (SRP) provides guidance to staff acting on rulemaking petitions to exempt from regulation radioactive waste determined to be below regulatory concern (BRC). The review plan is designed to ensure the quality and uniformity of staff reviews and to present a well-defined base for the staff's evaluation of BRC rulemaking petitions. The plan serves to improve the understanding of the staff's review by interested members of the public and the industry. It also provides information about the BRC rulemaking process to a wider audience. The two-step review consists of (1) an initial acceptance review to determine whether a petition for rulemaking complies with the requirements to 10 CFR Part 2 "Rules of Practice for Domestic Licensing Proceedings," section 2.802(c) "Petition for Rulemaking," combined with a regulatory and technical screening review for compliance with Commission policy contained in Appendix B to 10 CFR Part 2, "General Statement of Policy and Procedures Concerning Petitions Pursuant to §2.802 for Disposal of Radioactive Waste Streams Below Regulatory Concern;" and (2) a subsequent detailed regulatory and technical review for compliance with the aforementioned Commission policy. The SRP is primarily based on and follows the format of the Commission policy statement. Each individual SRP addresses the responsibilities of the reviewer, the matters that are reviewed, the Commission's regulations and acceptance criteria necessary for the review, how the review is accomplished, and the implementation requirements.

2666 (DOE/BP–1236) **Fan pressurization test results from the residential construction demonstration project: Cycle 1.** Harris, J. Bonneville Power Administration, Portland, OR (USA). 14 Apr 1989. 147p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002853. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

The Residential Construction Demonstration Project was designed to test innovative energy efficient construction techniques in electrically heated residential buildings. The first construction cycle of the program focused on innovative ventilation systems, air-tight construction and high R-value walls. The RCDP includes a data gathering and analysis component in order to evaluate the cost efficiency of the various innovations being tested. This report focuses on the data collected on the air sealing component of the project. The data gathering for the air tightening component of the project consisted of performing fan pressurization (blower door) tests on each house shortly after the home was constructed. This information was combined with information from a detailed site audit to evaluate the relative "tightness" of the homes and the probable causes of variations in performance. 14 figs., 3 tabs.

2667 (DOE/BP–1256) **Radon monitoring results from BPS's Residential Conservation Programs: Report No. 11.** US-DOE Bonneville Power Administration, Portland, OR (USA). Jul 1989. 35p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002854. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Listed on the following pages are the accumulated results of the Bonneville Power Administration regionwide Residential Conservation Programs radon monitoring received as of July 1, 1989. This data represents only those readings within the service areas of utilities (and the State of Washington, Department of Community Development) who participate in the Residential Weatherization, Super Good Cents, and Northwest Energy Code Programs. Several areas in the Pacific Northwest are excluded in this evaluation. In addition, the amount of results received is heavily weighted by the number of homes monitored through large utility conservation programs located in Western Oregon and Washington. Due to these limitations, we do not recommend that any conclusions be made on a statewide or regionwide basis. We have provided this regional and statewide data for illustrative purposes only. This report provides a summary of all the data collected for weatherized existing homes (WXN) and new homes built to model conservation standards (MCS) in the States of Oregon, Washington, Idaho, Montana, and Wyoming. Specific data is listed by US Geological Survey designated range and township locations. The specific data listed by range and township includes only those townships with a minimum of five random readings. This has been done to protect the privacy of those residences participating in the program.

2668 (DOE/BP–1273) **Northwest Residential Radon Standard: Volume 1, Project report.** Nuess, M. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Resource Management; Washington State Energy Office, Olympia, WA (USA). Oct 1989. 87p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002851. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Recognizing that building codes are designed to protect the life, health, and safety of occupants and that the economics involved in reducing radon levels in an existing home versus incorporating preventative measures in new homes, BPA contracted with the Washington State Energy Office to develop the Northwest Residential Radon Standard. The Radon Standard would provide builders, local jurisdictions and homebuyers an appropriate set of actions which could be taken during house construction to minimize indoor radon levels. The project was intended to provide: Effective, workable, and affordable technical specifications for installation into new homes during initial construction to minimize radon entry, especially in areas of potentially high radon levels. This model radon standard would be available for adoption by all jurisdictions in the Pacific Northwest with code adoption authority, and A generic plan for implementing the model standard in any jurisdiction in the Pacific Northwest.

2669 (DOE/BP–1274) **Northwest residential radon standard: Volume 2, Comment letters.** Nuess, M. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Resource Management; Washington State Energy Office, Olympia, WA (USA). Oct 1989. 59p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002850. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

These are letters of comment to the Northwest residential radon standard. (JEF)

2670 (DOE/BP/11287–12) **The Hood River Story: How a conservation project was implemented: Volume 1, Final report.** Schoch, K. (ed.). Pacific Power and Light Co., Portland, OR (USA).

Sep 1987. 104p. Sponsored by U.S. DOE Bonneville Power Administration; U.S. DOE Environment Health & Safety. DOE Contract AC79-83BP11287. Order Number DE90002779. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This Project had two principal components. One facet was the actual weatherization – a process which lasted 2-1/2 years. The second facet is the research, evaluation, and data collection effort. This work began two years before the start of field activity, and will formally continue until 1988, three years after weatherization completion. Data collected throughout the project are a continuing resource for conservation planners and energy policy decision makers. This volume concentrates on the field weatherization process. In addition to documenting the basic details of what occurred, the varying perspectives of management, the community, the staff, and the contractors are presented. 67 refs., 3 figs.

2671 (DOE/CE/15407–T2) **Extended range tankless water heater: Quarterly report No. 2, July 20, 1989–October 19, 1989.** Harris, J.A. Harmony Thermal Co., Wichita, KS (USA). 30 Oct 1989. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-89CE15407. Order Number DE90002561. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This is the second quarterly report for DOE/ERIP Project No. DE-FG01-89CE15407, Extended Range Tankless Water Heater. The objective of this project is to develop an innovative gasfired tankless water heater certified by AGA and ready for commercial sale. Relative to the planned timetable, we remain somewhat behind schedule at this point. According to the original timetable, we should be in the test phase for our engineering prototype. My estimate is that we are one to two months from that point at present. Part of the problem is that financial constraints demand that I continue to work part-time as an adjunct professor at Wichita State University. This takes time which could otherwise be spent on the project. Nevertheless, we continue to make significant progress, and the project is going well in that we have been successful with the tasks we have attempted thus far.

2672 (DOE/EIA–0321/1(87)) **Household energy consumption and expenditures, 1987: Part 1, National data.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 10 Oct 1989. 287p. Sponsored by U.S. DOE Management & Administration. Order Number DE90001588. Available from NTIS, PC A13/MF A01 - GPO - OSTI; GPO Dep.

Household Energy Consumption and Expenditures 1987, Part 1: National Data is the second publication in a series from the 1987 Residential Energy Consumption Survey (RECS). It is prepared by the Energy End Use Division (EEUD) of the Office of Energy Markets and End Use (EMEU), Energy Information Administration (EIA). The EIA collects and publishes comprehensive data on energy consumption in occupied housing units in the residential sector through the RECS. 15 figs., 50 tabs.

2673 (DOE/HWP–94) **Navy Radon Assessment and Mitigation Program progress report, September 1988–May 1989.** Wilson, D.L.; Dudney, C.S. Oak Ridge National Lab., TN (USA). Oct 1989. 223p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. (ORNL/M–993). Order Number DE90002910. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

The initial part of the prioritization phase of NAVRAMP has been completed. Through a competitive bidding process, a qualified vendor was selected to provide radon detectors and reports of the time-weighted average concentrations sampled. More than 22,800 radon detectors for placement in family housing units were shipped to 143 US naval facilities all over the world. Another 1956 detectors for placement in nonhousing structures were shipped to 206 facilities. One hundred eleven facilities received detectors for both housing and nonhousing structures. Facilities in tropical climates (e.g., Hawaii, Guam, the Philippine Islands, and Indonesia), were instructed to leave the detectors in place for about 3 months during the summer cooling season. All other facilities were instructed to leave the detectors in place for about a year. In addition to the detectors, the shipments included chain of custody letters, instruction packets, and detector placement data forms. To answer questions about the program and assist Base personnel in placing the detectors, a hot-line telephone number was established at the Analysas Corporation, Oak Ridge, Tennessee. Existing data bases obtained from the Navy are being updated. Data bases and associated data entry programs were developed to organize and manage the data that will become available as the detectors are placed and retrieved and as the measurement results are returned by the vendor. All official paper records of the project are being stored at Oak Ridge National Laboratory until they can be returned to the Navy. 4 refs., 7 tabs.

2674 (DTH-LV-MEDD–197) **Resource saving cassette building system for low energy houses.** Bolet, B.; Rasmussen, N.H.; Korsgaard, V. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering. Dec 1988. 163p. (In Danish). Order Number DE90718990. Available from NTIS (US Sales Only), PC A08.

In this report a description of the development of a new building system for low-energy houses is given. Cassette elements have been developed, which, in different forms, can be used for both floor, walls and roof in a standard house. The elements have been tested in a prototype standard house - the test house at Tovesvej 30, Naerum. For the test house an air heating system with heat pump has been developed. Both heating and climate technical measurements have been carried out in the test house first while it was still uninhabited and then for 6 months during actual habitation. The results of the measurements show that the heat consumption has been about 30% higher than expected according to the theoretic calculations also when considering the special conditions for habitation and the solar and weather conditions. Some technical examinations concerning construction and heating have been carried out in the house, which prove that the house is extremely tight with hardly any cold bridges and that the thermal comfort in the house is good. The heat insulating properties of the building envelope have not lived up to the theoretical value, and the heat pump has also been less efficient than expected. The measurements have been carried out at the same time as further developments of the cassette elements and proposals for a 2. generation low-energy house have been made. The economy as a whole of a 2. generation house is expected to become better than that of an ordinary house of similar standard. (BN).

2675 (ETDE-mf–0718079) **Noise pollution abatement for heat pumps with internal combustion engines. Illustrated by the large-capacity gas-fueled heat pumps in domestic and commercial buildings.** Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.). 1988. 108p. (In German). Order Number DE90718079. Available from NTIS (US Sales Only), PC A06/MF A01.

The brochure deals with questions on noise pollution abatement for heat pump plants with outputs between 200 and 1200 kW. It is intended to give purchasers and operators of heat pumps with internal combustion engine drive technically based information on how adverse effects on the environment by noise can be avoided. The brochure contains many measurements of noise emission from plants in operation and on noise propagation in buildings. These act as the basis for deriving and describing measures to reduce noise. The emission measurements were taken on 13 gas engine heat pumps, 5 gas engines and 3 refrigerant compressors. The latter were in electrical heat pumps. (BR).

2676 (ETDE-mf–0718199) **Experimental and theoretical investigation of passive use of solar energy on house facades.** Meyer, K. Kassel Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 15 - Maschinenbau. 30 Mar 1987. 176p. (In German). Order Number DE90718199. Available from NTIS (US Sales Only), PC A09/MF A01.

The aim of a research project was to examine the effect of solar radiation on selected solar wall designs. First the effect of wall design on the heat balance of the space inside was determined (single, glazed, insulated outside walls, heat pipe wall, theory, design built). Experimental investigations were carried out on models with different wall designs (model of building, temperature, speed of flow of outside air, solar radiation, inside space temperature, build-up of solar facades, measurement and control devices). The results of experiments are interpreted and the reproduceability of heat energy is dealt with. Differential equations for non-steady state heat

transport are given for the mathematical model, boundary conditions are named (types of heat transfer) and comparisons are made of measured and calculated results. Finally, different wall designs are judged regarding the saving of heat energy. (HWJ).

2677 (ETDE-mf–0722342) **Evaluation of the energy conservation program for the NMB bank offices.** Fugro Geotechniek BV, Arnhem (Netherlands). Oct 1988. 33p. (In (In Dutch)). (NOVEM–89-001). Order Number DE90722342.

The title project was carried out by the NMB bank (a Dutch bank) during the period 1983-1986. A description is given of the project history, the way in which the employees have been motivated, and the so-called 'Stookproef', ent to inform the personnel in the increase of degree days. Overall recommendations are given with regard to the energy conservation measures. Data acquisition and data processing of the energy consumption are discussed per office. Evaluation of the energy conservation data before and after the conservation measures was done in order to determine the accuracy of predicting energy conservation quantities. A positive, overall conclusion is given with regard to the possibility to predict results of energy conservation. Appendices and figures are published in a separate report. 16 figs., 3 tabs., 10 app.

2678 (ETDE-mf–0722344) **Evaluation of the energy conservation program for the NMB bank offices. Appendices and figures.** Fugro Geotechniek BV, Arnhem (Netherlands). Oct 1988. 85p. (In (In Dutch)). (NOVEM–89-002). Order Number DE90722344.

The title project was carried out by the NMB (a Dutch bank) during the period 1983-1986. For the actual report a separate abstract has been prepared. This report presents the numerical and compiled data. For 9 regions in the Netherlands data with regard to the different offices are presented: data on the construction, heating and electrical installations, energy balance, energy consumption and energy conservation, prices, investments, cost-benefit analysis and pay back periods.

2679 (GB–206) **Condensing boilers.** Department of Energy, London (UK). Energy Efficiency Office. Dec 1988. 8p. (Digest–339). Order Number DE90722716. Available from NTIS (US Sales Only), PC A02.

For both commercial and domestic use, condensing boilers represent a new generation of heating appliance. They can be used in most buildings, new and existing, large and small, with valuable savings in energy. Payback of the additional capital cost over conventional boilers usually occurs within one to five years. There are some cases where condensing boilers are not economically attractive, but these are the exception rather than the rule. This digest summarises selection, system design, installation, commissioning and maintenance and gives advice on economic appraisal. (author).

2680 (IBP-WB–11/87) **Are the external heat transfer coefficients correct?.** Erhorn, H.; Gertis, K.; Rath, J.; Szerman, M. Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.). Bereich Waerme/Klima. 1987. 12p. (In German). Order Number DE90718064. Available from NTIS (US Sales Only), PC A03/MF A01.

For measurement on normally insulated external walls, one could prove that the external component surface temperatures were below the outside air temperature for more than half the measuring time. This phenomenon cannot be described by the K value, by definition. When relating the external heat transfer coefficient conditional on radiation to air temperatures, practical conditions cannot be satisfactorily simulated. For energy considerations, this simplification seems to be uncritical, however. One therefore wants to examine in future whether by revision of the heat transfer coefficient or the temperature boundary conditions to be selected, e.g. as a mixed value of the air and radiation temperature, one can find a means which will describe the real conditions more satisfactorily, on the one hand, and on the other hand will be as simple to handle as the equations used at present. (orig./HW).

2681 (IKE–7-9) **Computer-aided analysis of heating pipe networks.** Grammling, F. Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme. 1988. 141p. (In German). Order Number DE90718198. Available from NTIS (US Sales Only), PC A07/MF A01.

The most frequent problems in operating hot water heating systems are due directly or indirectly to the pipe network. The aim of research work explained in detail, was to develop a computer-aided process for heating pipe networks, with the aid of which, by measuring differential pressure and flow at just one central place in the pipe network, the actual hydraulic resistances can be determined. Previously known processes of pipe network analysis and computer-aided analysis of heating networks (model, method of analysis) and the computer program NETAN produced for it (construction, extent of measurements, fault-finding, simulation) are dealt with. Experimental testing follows this. (HWJ).

2682 (KTM/E-D–172) **Alternative development programme of the projects concerning the building management control.** Jauhiainen, J.; Hermuen, M.; Pyyskaenen, S. Kauppa- ja Teollisuusministerio, Helsinki (Finland). Energiaosasto. 1989. 67p. (In Finnish). Order Number DE90719328. Available from NTIS (US Sales Only), PC A04.

The concept 'ntelligent buildingis already a relatively established term in articles concerning the building area. The invasion of the applications within the building management control into the buildings is based more on the activity of the suppliers and salesmen than on the actual needs of the users. The automatization has happened almost secretly; the applications have not been considered as entireties and by taking into account their real meaning and the influence of other systems used in the building. The lack of clear structural and functional definitions and keeping to the traditional modes of acting in the electrical planning and realization are the main obstacles for the realization of the goal oriented and useful automation applications. In this report we have stated some general discriptions and definitions to specify the essential functions and data exchange as to the automation system, application and planning. Furthermore, there is stated a project model, which enables the sufficient flexibility in different building situations.

2683 (KTM/E-D–173) **Displacement ventilation - dimensioning of supply air flow.** Tapola, M.; Koivula, K. Kauppa- ja Teollisuusministerio, Helsinki (Finland). Energiaosasto. 1989. 81p. (In Finnish). Order Number DE90719324. Available from NTIS (US Sales Only), PC A05/MF A01.

A supply air flow dimensioning guide for spaces equipped with displacement ventilation systems has been developed in this research. The guide's basic data consists of the internal heat load properties of the ventilated space. The supply air flow provided by the guide will ensure vertical stratification of impurities which will cause air quality in the occupation zone to improve to the ratio of 3 if compared with the upper zone. The dimensioning quide is valid only for thermal displacement i.e. where impurities are warmer than the ambient air and the thermal stratification is clear. The dimensioning quide is based on the theoretical model where the displacement ventilation system is simulated by differential equations governing the rising plume generated by a thermal source. The model has been modified by empirical data obtained from the laboratory tests. In these tests, the behaviour of contaminant concentration stratification in displacement ventilation system was studied by alternating the supply air flow and the internal heat load properties of the space. Stratification was measured by tracer gas technique. The results of the laboratory findings have been fitted to the theoretical model and the standard error of the regression analysis is less than 20%. Field measurements have been carried out in several displacement ventilation systems. Experiments have shown that in the dimensioning of the displacement ventilation system a more precise knowledge of the basic data is required than in the dimensioning of the mixing ventilation system. The values obtained from the dimensioning quide and the results of the field measurements have been compared. The results were found to be similar in cases where the thermal stratification was clear.

2684 (KTM/E-D–174) **Design instructions for ventilation of day-care centres.** Leino, O.; Sallinen, V. Kauppa- ja Teollisuusministerio, Helsinki (Finland). Energiaosasto. 1989. 59p. (In Finnish). Order Number DE90719327. Available from NTIS (US Sales Only), PC A04/MF A01.

The paper studied the operation of the ventilation systems used in day-care centres in the City of Espoo. The costs and potential uses of different ventilation system arrangements were clarified by

experimental building. The object of the study was the Espoonlahti day-care centre, where the following ventilation system arrangements were tested: ventilation zones, use of transferred air between group rooms and boosting of ventilation in the gymnasium and in the kitchen. The results of the study produced two different reports. This report Design Instructions for Ventilation of Day-care Centresis meant to be a tool, in particular, for planning ventilation for day-care centres. The test results of the Espoonlahti day-care centre are presented in the report Experimental Building of Day-care Centres which is available from the Building Planning Department of the Technical Office of the City of Espoo.

2685 (LBL–20090) **Market share elasticities for fuel and technology choice in home heating and cooling.** Wood, D.J.; Ruderman, H.; McMahon, J.E. Lawrence Berkeley Lab., CA (USA). May 1989. 45p. Sponsored by U.S. DOE Conservation & Renewable Energy; Electric Power Research Institute. DOE Contract AC03-76SF00098. Order Number DE90002606. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A new technique for estimating own- and cross-elasticities of market share for fuel and technology choices in home heating and cooling is presented. We simulate changes in economic conditions and estimate elasticities by calculating predicted changes in fuel and technology market shares. Elasticities are found with respect to household income, equipment capital cost, and equipment capital cost, and equipment operating cost (including fuel price). The method is applied to a revised and extended version of a study by the Electric Power Research Institute (EPRI). Data for that study are drawn primarily from the 1975–1979 Annual Housing Surveys. Results are generally similar to previous studies, although our estimates of elasticities are somewhat lower. We feel the superior formulation of consumer choice and the currency of data in EPRI's work produce reliable estimates of market share elasticities. 18 refs., 1 fig., 6 tabs.

2686 (LBL–20332) **A review of assumptions and analysis in EPRI EA-3409: "Household appliance choice: Revision of REEPS [Residential End-use Energy Planning System] behavioral models".** Wood, D.J.; Ruderman, H.; McMahon, J.E. Lawrence Berkeley Lab., CA (USA). May 1989. 29p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002609. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper revises and extends EPRI report EA-3409, "Household Appliance Choice: Revision of REEPS Behavioral Models." That paper reported the results of an econometric study of major appliance choice in new residential construction. Errors appeared in two tables of that report. We offer revised versions of those tables, and a brief analysis of the consequences and significance of the errors. The present paper also proposes several possible extensions and re-specifications of the models examined by EPRI. Some of these are judged to be highly successful; they both satisfy economic intuition more completely than the original specification and produce a better quality fit to the dependent variable. We feel that inclusion of these modifications produces a more useful set of coefficients for economic modeling than the original specification. 8 refs., 15 tabs.

2687 (LBL–20333) **A study of aggregation bias in estimating the market for home heating and cooling equipment.** Wood, D.J.; Ruderman, H.; McMahon, J.E. Lawrence Berkeley Lab., CA (USA). May 1989. 33p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002608. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Econometricians frequently propose parametric models which are contingent on an underlying assumption of rational economic agents maximizing their utility. Accurate estimation of the parameters of these models depends on using data disaggregated to the level of the actual agents, usually individual consumers or firms. Using data at some other level of aggregation introduces bias into the inferences made from the data. Unfortunately, properly disaggregated data is often unavailable, or at least, much more costly to obtain than aggregate data. Research on consumer choice of home heating equipment has long depended on state-level cross-sectional data. Only recently have investigators been able to build up and successfully use data on consumer attributes and choices at the household level. A study estimated for the Electric Power Research Institute REEPS model is currently one of the best of these. This paper examines the degree of bias that would be introduced in that study if only average data across SMSAs or states were used at several points in the investigation. We examine the market shares and elasticities estimated from that model using only the mean values of the exogenous variables, and find severe errors to be possible. However, if the models were calibrated on only aggregate data originally, we find that proper treatment allows market shares and elasticities to be found with little error relative to the disaggregate models. 22 refs., 4 figs., 10 tabs.

2688 (LBL–20645) **Factors influencing soil as a source of indoor radon: Framework for assessing radon source potential.** Nazaroff, W.W.; Moed, B.A.; Sextro, R.G.; Revzan, K.L.; Nero, A.V. Lawrence Berkeley Lab., CA (USA). Jul 1989. 141p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research; Environmental Protection Agency. DOE Contract AC03-76SF00098. DW89930801-01-0. Order Number DE90002607. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

In less than a decade the consensus concerning the nature and extent of the problem of radon in indoor air has been radically revised. Rather than simply a problem that arises due to molecular diffusion of radon from industrially contaminated building materials or fill materials, we now recognize that the vast majority of structures with elevated indoor concentrations are unexceptional in other regards. In most cases, radon enters predominantly via the substructure through convective flow augmented by molecular diffusion. The importance of soil as a source of indoor radon and the importance of the convective flow process for radon entry are seen in the considerable success of control measures directed at reversing the ordinary direction of flow of soil gas through pathways across the building substructure. We have described and discussed mechanisms of radon generation in soil and entry into the soil pore space, the physics of radon migration through soil, and the driving forces that generate pressure gradients in the soil surrounding buildings which lead to convective migration of radon into buildings. A mathematical description of radon concentration in the soil pore space has been developed that accounts for production and removal by radioactive decay and for diffusive and convective flow through the soil. We have reviewed the important soil and climatic variables that influence these processes and have attempted to evaluate their effects. 190 refs., 19 figs., 13 tabs.

2689 (LBL–27140) **Center for Building Science of the Applied Science Division annual report, FY 1988.** Cairns, E.J.; Rosenfeld, A.H. Lawrence Berkeley Lab., CA (USA). May 1989. 114p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE90002603. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Center for Building Science consists of four programs in the Applied Science Division. It was established to provide an umbrella so that groups in different programs but with similar interests could combine to perform joint research, develop new research areas, share resources, and produce joint publications. As detailed within, potential savings for the US society from energy efficient buildings are enormous. But these savings can only be realized through an expanding federal R and D program that develops expertise in this new area. The Center for Building Science develops efficient new building components, computer models, data and information systems, and trains needed building scientists.

2690 (LBL–27534) **A versatile procedure for calculating heat transfer through windows.** Arasteh, D.K.; Reilly, M.S.; Rubin, M.D. Lawrence Berkeley Lab., CA (USA). May 1989. 25p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-890609–6: ASHRAE annual meeting, Vancouver (Canada), 24-28 Jun 1989). Order Number DE90003126. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Advances in window technologies and the desire to standardize the reporting of standard window heat transfer indices have necessitated the development of a comprehensive analytical procedure for calculating heat transfer through windows. This paper shows how complete window heat transfer can be considered as the area-weighted sum of the three window component areas: the

center-of-glass area, the edge-of-glass area, and the frame area. Algorithms for calculating heat transfer through each of these areas and for combining these to calculate total window indices are presented. 36 refs., 5 figs., 6 tabs.

2691 (LBL–27692) **Monitoring and modeling for radon entry into basements: A status report for the small structures project.** Fisk, W.J.; Flexser, S.; Gadgil, A.J.; Holman, H.Y.; Modera, M.P.; Narasimhan, T.N.; Nuzum, T.; Revzan, K.L.; Sextro, R.G.; Smith, A.R. Lawrence Berkeley Lab., CA (USA). Sep 1989. 59p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8909250–1: Radon contractors conference, Fort Collins, CO (USA), 20-22 Sep 1989). Order Number DE90002456. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The approach, status, and initial findings of a research project on radon transport through soil and entry into buildings are described. We have constructed two room-size precisely-fabricated basements at a site with relatively homogeneous soil. The structures have adjustable-size openings to the soil, are otherwise very air-tight, and are mechanically ventilated using a system that also controls the indoor-outdoor pressure difference. Numerous probes have been installed in the soil surrounding the structures to permit multipoint measurement of soil moisture content, soil temperature, permeability of soil to air, soil-gas pressure and radon concentration. State-of-the-art instrumentation is being installed for real-time monitoring of these parameters plus structure ventilation rate, indoor and entering soil-gas radon concentrations, and meteorologic parameters for a period of at least one year. Many of the factors that control or influence radon entry will be modified intentionally or by changes in environmental parameters during the course of the measurements. We have found it necessary to design and fabricate a new type of probe for more accurate measurements of soil permeability. We have also verified and improved procedures for more accurate, rapid, multipoint measurements of radon concentrations using a continuous radon monitor. Identical structures, with the same instrumentation, will be constructed at additional sites with difference soil characteristics and climates. Core samples of the soil from each site are analyzed to determine density, porosity, permeability, radium content, and radon emmanation coefficient. The research project also includes steady-state and transient numerical modeling efforts that complement the experimental research and that will use the experimental data for model validation. 32 refs., 12 figs., 5 tabs.

2692 (NCRP–103) **Control of radon in houses.** National Council on Radiation Protection and Measurements, Bethesda, MD (USA). 1 Sep 1989. 95p. Available from National Council on Radiation Protection and Measurements, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814.

This report, drafted by NCRP Scientific Committee 82 on Control of Radon in Houses, evaluates the techniques available to reduce radon and radon decay product concentrations. It is intended that this report would be useful to home owners, to individuals involved in marketing services to reduce radon and radon decay products in houses, and to the scientific community interested in control techniques for radon and radon decay products. Sections 1 and 2 of the report provide background information on the public health significance of indoor radon and on the sources and behavior of this radionuclide and its airborne decay products inside houses. The reader desiring information primarily on the control of radon may prefer to shift to Section 3 immediately after reading the Introduction. Included in Section 6 of the report are tables comparing the removal effectiveness and estimated costs of various control techniques, and a glossary of terms used in the report is provided.

2693 (ORNL–6487) **Investigation of radon entry and effectiveness of mitigation measures in seven houses in New Jersey.** Dudney, C.S.; Hubbard, L.M.; Matthews, T.G.; Socolow, R.H.; Hawthorne, A.R.; Gadsby, K.J.; Harrje, D.T.; Bohac, D.L.; Wilson, D.L. Oak Ridge National Lab., TN (USA). Aug 1989. 312p. Sponsored by U.S. DOE Energy Research; Environmental Protection Agency; New Jersey Department of Environmental Protection. DOE Contract AC05-84OR21400. Order Number DE89016676. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

This report describes the results from a year-long, intensive, instrumented study of radon entry processes and the effectiveness of radon mitigation measures in seven occupied New Jersey houses. All of the houses that were studied are basement houses that had elevated radon levels (i.e., greater than 400 and less than 7500 Bq m^{-3}) prior to the study. Various mitigation strategies were evaluated in the houses. The most successful strategy was depressurization of the soil beneath the concrete slab of the basement. To achieve subslab depressurization, one or more slab penetration points were selected for each house. The most important diagnostic measurement in selection of effective slab penetration points was testing of air flows between potential penetrations and points on the slab perimeter. Careful sealing of the wall to the slab was found to increase the effective zone of depressurization beneath the slab. 100 figs., 35 tabs.

2694 (PB–89-184428/XAB) **Effect of shading devices on residential energy use in Austin, Texas. Research report.** Pletzer, R.K.; Jones, J.W.; Hunn, B.D. Texas Univ., Austin, TX (USA). Center for Energy Studies. Jun 1988. 166p. (CONSERV-SOLAR-RR–5). Available from NTIS, PC A08/MF A01.

This report presents the results of an analytical study of the effect of shading devices on the annual heating, cooling, and total energy use, on summer peak electric demand, and on energy cost savings in single-family residences in Austin, Texas. With an hourly building energy-analysis model, savings were simulated for interior and exterior shading devices. No analysis of the costs of installing and operating these devices was made. Results are presented in terms of annual heating and cooling energy use and energy costs with each shading device in place as compared to baseline reference cases for three prototypical residences. The devices are ranked in terms of energy cost savings.

2695 (PB–89-213904/XAB) **Development of high-efficiency scroll compressors for air conditioners.** Hirano, T.; Hagimoto, K.; Matsumura, N.; Hori, M.; Takeda, K. Mitsubishi Heavy Industries Ltd., Tokyo (Japan). 1989. 6p. Available from NTIS, PC EE05.

Text in Japanese; Pub. in Mitsubishi Juko Giho, Vol. 26, No. 1, 66-71(1989).

As for recent heat-pump air conditioners, compressors are required to operate in a wide speed range by means of inverter drive and wide operating pressure range. From the points of high efficiency, high reliability, etc., scroll compressors have recently been used. To accomplish high efficiency, self-sealing mechanisms such as a tip seal and a swing-link mechanism, are very effective. The authors have developed high-efficiency hermetic scroll compressors with self-sealing mechanisms. The scroll compressors have capacity control function and can be driven by an inverter. In this report, the authors discribe the characteristics of global performance simulation that was developed for scroll-compressor analysis and experimental studies of the internal behavior of scroll compressors.

2696 (PB–89-224521/XAB) **Measurement of condensable vapor contribution to PM10 emissions.** Williamson, A.D.; Martin, R.S.; Harris, D.B. Southern Research Inst., Birmingham, AL (USA). 21 Jun 1985. 19p. Available from NTIS, PC A03/MF A01.

This paper describes the wood-stove dilution-sampling system, the results of laboratory characterization of the device, and field measurements of residential woodstove emissions. Under EPA contract, a stack dilution sampling system (SDSS) for field measurement of condensable emissions was designed and constructed . This train was used to measure condensable components of inhalable particulate matter at several sources. Also developed under EPA contract was the ESDSS, a reduced-scale dilution sampling system, which is mechanically suitable for fireplace and woodheater emissions measurement. Residential wood stoves emit large quantities of condensable as well as volatile and semi-volatile organic species. Thus, in order to adequately assess the effect of wood stove particulate emissions on the near-source environment, measurement techniques must be used that do not discriminate against the condensable emissions. Ambient particulate samplers collect the wood stove particulate matter after the plume-mixing dilution and cooling process.

2697 (PB–89-230619/XAB) **Conventional research house: Cooling characterization test results. Topical report, June-September 1987.** Leslie, N.P.; Hedrick, R.L.; Ghassan, P.G. Rutgers–the State Univ., Piscataway, NJ (USA). Dept. of Chemical

and Biochemical Engineering. Sep 1988. 104p. Available from NTIS, PC A06/MF A01.

Baseline cooling-characterization tests were conducted at GRI's Conventional Research House in Chicago, Illinois. A commercially available high efficiency electric air conditioner with two-speed condensing unit and A-coil in the furnace bonnet was used as the baseline cooling system. The low-speed capacity was 22,000 BTUH and the high-speed capacity was 31,000 BTUH. The baseline operating strategy was continuous cooling with a central two-stage thermostat setpoint of 75 F. The research house was moderately furnished to approximate conditions of occupancy for a family of three. Occupancy and appliance-simulation protocols were implemented in accordance with GRI's Research House Utilization Plan throughout the test period. A data-acquisition system monitored over 100 data channels on a minute-by-minute and hourly basis to characterize comfort, energy consumption, and dynamic response of the baseline system. The unit ran in the low-speed mode during 95% of all operating hours. The air-conditioning system maintained good comfort conditions throughout the summer in the upstairs zones, and acceptable humidity levels in the basement zone, which was somewhat cooler. The system energy-efficiency ratio was 10.6 in low-speed operation and 9.9 in high speed operation. Seasonal energy consumption was 1,133 kwh.

2698 (PNL–6984) **Summary of residential environmental issues and program consistency.** Baechler, M.C. Pacific Northwest Lab., Richland, WA (USA). May 1989. 40p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC06-76RL01830. Order Number DE90002738. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Northwest Power Planning Act authorizes the Bonneville Power Administration to acquire all necessary energy resources to serve Northwest utilities choosing to acquire power from the agency and to give conservation the highest priority in responding to the demand for electricity. To meet this mandate, the agency has established residential conservation programs for weatherizing existing homes, building new energy-efficient homes, and promoting energy-efficient appliances. Pacific Northwest Laboratory prepared this report to compare and contrast the environmental requirements and issues involving Bonneville's residential conservation programs. The key environmental concern confronting each of the programs with measures aimed at reducing air leakage rates in houses (both new and existing) is indoor air quality (IAQ). This report reviews the similarity and consistency of the programs' approach to IAQ, their impacts, program features, mitigation techniques, and new information about IAQ and other potential environmental issues confronting the programs. The information is intended for use in comparing and contrasting how environmental features mesh with other program features, checking consistency across programs and determining whether it makes sense for programs to be consistent, determining consistency between programs, and providing information to aid program planning in light of potential environmental issues and new information. 31 refs.

2699 (PNL-SA–17311) **Beyond the IDMY [International Daylighting Measurements Year]: A network instrument for low-cost data acquisition.** Michalsky, J.J.; Perez, R.; Harrison, L.; LeBaron, B.A. Pacific Northwest Lab., Richland, WA (USA). Jul 1989. 12p. Sponsored by U.S. DOE Conservation & Renewable Energy; New York State Energy Research and Development Authority. DOE Contract AC06-76RL01830. 724CONDCS85. (CONF-8910285–1: Symposium on daylighting and solar radiation measurement, Berlin (Germany, F.R.), 9-11 Oct 1989). Order Number DE90002722. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The International Daylighting Measurements Year (IDMY) network will acquire a data base to test models that convert solar irradiance data to daylight availability data for all skies and geometries. These models will subsequently be used to convert routine solar irradiance data to the desired daylight quantities. This paper briefly describes an instrument that provides for a substantial reduction in capital and maintenance costs associated with acquiring diffuse and total horizontal and direct normal irradiance. It outlines a simple procedure for correcting the silicon cell sensor to yield root-mean-square errors within 10 watts/meter^2 of first-class thermopile pyranometers and pyrheliometers. 3 refs., 5 figs., 3 tabs.

2700 (SERI/CP–254-3000) **Desiccant cooling and dehumidification opportunities for buildings workshop.** Penney, T.R. (comp.). Solar Energy Research Inst., Golden, CO (USA). Oct 1989. 211p. Sponsored by Electric Power Research Institute. DOE Contract AC02-83CH10093. (CONF-8606431–: Solar Energy Conservation Training Institute workshop on desiccant cooling and dehumidification opportunities for buildings, Chattanooga, TN (USA), 10-11 Jun 1986). Order Number DE89009490. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Desiccant cooling and dehumidification technology is gaining acceptance as an option for air-conditioning buildings. Over the last few years, significant advances have been made in desiccant cooling and dehumidification in the private and public sectors. market penetration of desiccant systems in the past has been limited to unique applications. This workshop was an open forum for discussing these unique and potential applications. Workshop participants discussed the state of the art of desiccant materials, components, systems, and applications, both theoretically and experimentally. This document is a compilation of the papers presented in the workshop sessions.

2701 (STF–15A88028) **Simulation of energy consumption by taking thermal comfort into account.** Bryn, I. Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Jul 1988. 13p. Order Number DE90719391. Available from NTIS (US Sales Only), PC A03/MF A01.

This program called COSIM is designed for simulation of thermal comfort and energy consumption in buildings with different heating and ventilation systems. The room model has two air zones, seven walls with or without heating and two windows. The analysis of thermal comfort is based on ISO standard 7730: Moderate thermal environments - Determination of the PMV and PPD indices and specification of the condidions for thermal comfort· The energy analysis part uses the results from the thermal comfort part to calculate energy consumption controlled by the operative temperature or the air temperature. 6 refs., 3 figs., (Author).

2702 (TNO-HMT–88-342) **Measuring heat flows in collective heating systems. Illusion or reality.** Brand, R.A.; Van Wolferen, J.; Mol, A. Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands). Dec 1988. 80p. (In (In Dutch)). (NOVEM–89-017). Order Number DE90722472.

General regulations for the Netherlands in the field of heat measurement and spreading of heating cost charges are not yet available. However, the number of different measuring methods as a means to spread the charges is large. A uniform measuring method appears to be necessary. By means of a calculation model the impacts of construction and installation of a collectively heated building as well as the attitude of the occupants on the heat flow distribution have been determined. The impact of heat flows between houses is limited for the distribution problem in case of similar consumer behavior. The applicability of different measuring methods has been determined for gallery apartments with vertical supply- and return pipes per radiator and for one-family dwellings with a central supply- and return connection. Recommendations are made for the appropriate distribution method with regard to heat charges in high-rise flats or low-rise buildings. A separate abstract has been prepared for the supplementary report with 30 appendices and 129 figures. 25 refs.

2703 (TNO-HMT–88-342/Suppl) **Measuring heat flows in collective heating systems. Appendices and figures.** Brand, R.A.; Van Wolferen, J.; Mol, A. Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands). Dec 1988. 165p. (In (In Dutch)). (NOVEM–89-018). Order Number DE90722473.

By means of a calculation model the impacts of construction and installation of a collectively heated building as well as the attitude of the occupants on the heat flow distribution have been determined in order to make an equitable spread of heating costs. A separate abstract has been prepared for the main report. Here the appendices and figures are presented with technical data on the apartment

buildings and the one-family dwellings and statistical data on the energy consumption in the different buildings. 129 figs., 30 apps.

2704 (TNO-HMT-R–88/253C) **Investigation of the indoor air quality of renovated houses in Bois-le-Duc, Netherlands.** Van der Wal, J.F.; Van Dongen, J.E.F.; Cornelissen, H.J.M.; Moons, A.M.M.; Steenlage, R. Fugro Geotechniek BV, Arnhem (Netherlands). Feb 1989. 232p. (In (In Dutch)). (NOVEM–89-039). Order Number DE90722455.

Indoor air pollution, ventilation, energy consumption and occupants comfort have been investigated for renovated one-family dwellings in the residential area 'De Slagen' in Bois-le-Duc, Netherlands. Airtight facades with ventilation facilities were realized during the renovation. Two balanced ventilation systems were applicated which differ in the air supply method. The concentrations of CO_2, total and respirable dust, formaldehyde and acrolein, carbon monoxide and nitrogen oxides, temperature and relative humidity were recorded for two whole days in occupied houses. Also the air current volumes of the mechanical ventilation systems and the air permeability of the houses were measured. The occupants' behavior during the measurements was kept in a diary by the occupants themselves. Relations between ventilation, indoor temperature and energy usage were looked for by means of an occupants survey. Data were collected on occupant acceptation of and experience with the system. 29 figs., 14 refs., 36 tabs., 11 apps.

2705 (VTT-TIED–829) **Efficiency measurements of ventilation.** Enbom, S. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Jan 1988. 45p. (In Finnish). Order Number DE90719348. Available from NTIS (US Sales Only), PC A03/MF A01.

This report presents the theoretical basics of the commonly used ventilation efficiency measuring methods, the reduction and the source methods. The usability of these both methods were evaluated by measurements done in the same conditions. Also methods to measure the concentration of tracer gases are presented.

2706 (VTT-TIED–982) **Heating energy flexibility of dwellings.** Haapalahti, P. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. 96p. (In Finnish). Order Number DE90719346. Available from NTIS (US Sales Only), PC A05/MF A01.

The problem area under study concens the heating of dwellings fluctuations in energy supply. The research has been restricted to dwellings only and those activities linked to energy production and transportation have been excluded. During energy shortage, homeowners are faced with two alternatives: to cut down their energy consumption or to use other forms of energy as substitutes for primary energy. In the case of a serious crisis regarding domestic fuel, wood in particular can be considered as a viable alternative. However, when considering present-day installations, any increase in use of wood as a fuel must be seen as limited. Thus the saving of energy in times of shortage is rendered still more important. Energy-savings is, of course, possible in terms of reduced comfort and quality factors in comparison to those preveiling under normal circumstances. For example, indoor temperatures can be lowered, ventilation diminished or the consumption of warm water deccreased. With respect to saving activities, the adjustability of heating and ventilation should be as efficient as possible. With regard to altering situations regarding energy prices, energy flexibility means, primarily, changing energy sources. Replacing an energy source is, however, a quite an expensive operation and economic dependence on the chosen system is considerable.Energy flexibility, particularly in the choice of main heating system, is easiest to achieve during new building phases and can be improved by recourse to various main solutions such as, for instance, the construction of fireplace. Mechanical incoming and exhaust air system can be chosen for direct electrical heating for a ventilation system. The control of the indoor temperature and ventilation of each separate room can be developed in all heating systems.

2707 (VTT-TIED–1028) **Evaluation of the thermal performance of the building envelope of existing buildings.** Kauppi, A. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. 124p. (In Finnish). Order Number DE90719347. Available from NTIS (US Sales Only), PC A06/MF A01.

Defects in thermal insulation and air tightness - usually called thermal defects - in the external envelope of our buildings lead to many kinds of inconveniences, like low temperatures on structures, draught, moisture damages and to some degree additional consumption of energy too. In order to find proper and the best possible repair methods, we first have to find out, what is the reason for different inconveniences. The main problem is often to find suitable methods and equipment to evaluate the thermal condition in practice. At first a brief literature study has been carried out as well as researchers' own experiences on the most usual thermal faults and defects in buildings have been listed. When the thermal consition is evaluated, we should, in order to optimize available resources, search for defects in places typical for each structure. Further the study clarifies, which kind of evaluation methods exist for the investigation of thermal condition and their usability. Available methods may vary from the simplest, like senses, to quite well developed methods like thermography etc. The project also comprised laboratory and field tests, by means of which the accuracy and suitability for practice of different measuring and evaluating methods were studied. The results of these tests show that there are differences between equipment and methods employed. Methods, equipment and combinations of equipment for evaluation are on the basis of the research proposed to be dealt in three different levels. Whichever of these levels is to be used, depends primarily on the aims and level of requirements we set to the results of evaluation. The level of evaluation method also depends essentially on available methods and equipment as well as the ability of the evaluating person to take advantage of these methods.

2708 **A thermally insulating vacuum window.** Garrison, J.D. (Physics Dept., San Diego State Univ., San Diego, CA (US)). pp. 544 of Solar engineering - 1989. Fanney, A.H.; Lund, K.O. American Society of Mechanical Engineers, New York, NY (1989). (CONF-890436–: 11. annual American Society of Mechanical Engineers solar energy conference, San Diego, CA (USA), 2-5 Apr 1989).

Much of the energy transfer between the inside of buildings and the outside environment is through the windows. Small prototypes of a relatively inexpensive thermally insulating vacuum window, which can reduce this energy transfer, have been fabricated and tested in the laboratory. This window is formed from two glass sheets, which are shaped to withstand the force from atmospheric pressure when the space between the glass sheets is evacuated. One or both of the inside surfaces of the two glass sheets are coated with an infrared reflecting coating to reduce radiative heat transfer. This vacuum window has high transmission of visible light. Distortion of the light makes it less suitable for viewing. The two glass sheets are shaped at a temperature somewhat above 800 C. They are sealed together by applying pressure around their outside edges and at internal points of contact, of very limited area, at a temperature near 700 C. Heat transfer calculations for this window have been performed.

3202 Transportation

Refer also to citation(s) 2618, 2658, 2787, 2791, 2980

2709 (CONF-890790–3) **Opportunities and prospects for Maglev in North America.** Eastham, T.R.; Coffey, H.T. Argonne National Lab., IL (USA). [1989]. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 5. world conference on transport research; Yokohama (Japan); 10-14 Jul 1989. Order Number DE90002190. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

As a result of early research in many countries, including the USA and Canada, and developments particularly in the Federal Republic of Germany and in Japan, the technologies of magnetic suspension and linear electric drives have matured to the stage at which low-speed systems are operational and high-speed systems have reached prototype test and demonstration. Maglev is now recognized as a realistic option for the 1990s and is being assessed in parallel with high-speed rail service in many corridor studies. Maglev is becoming available at a time when both road and air congestion is threatening the mobility that North America has come to expect. The fast, clean, energy-efficient characteristics should allow Maglev systems to contribute to the solution of impending transportation problems. This paper reviews the opportunities and prospects for the implementation of Maglev in North America. 12 refs., 1 fig., 1 tab.

2710 (NASA-CR–185163) **The Gevaltig: An inertial fusion powered manned spacecraft design for outer solar system missions.** Murray, K.A. Rockwell International Corp., Canoga Park, CA (USA). Energy Technology Engineering Center. Oct 1989. 44p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC03-76SF00700. (ETEC–89-7). Order Number DE90002624. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Gevaltig is an inertial fusion powered rocket engine capable of manned missions to other planets with round trip mission times as low as 100 days. The Gevaltig design was previously described for a mission to Mars. This effort defines the spacecraft components in terms of mass and presents a mission analysis for a manned trip to Titan, a moon of Saturn. The Gevaltig component masses are provided as a function of fuel pellet ignition frequency. These variable mass components include the fuel tanks, radiators, structure and EM pumps. Fixed mass components include the drivers, coil, coil shield, power processing system, payload, crew shield and laser mirrors. A 6 MW nuclear reactor is included in the design for startup purposes. Various combinations of thrust, mission duration and specific impulse were evaluated to determine a reasonable mission scenario for the Titan mission. The mission analysis yielded several viable mission scenarios, with round trip durations of 370 to 500 days and initial (launch) masses from lunar orbit of 2500 to 20,000 metric tons. 15 refs., 13 figs., 14 tabs.

2711 (PB–89-211072/XAB) **Revised manual for planning, designing, and operating transitway facilities in Texas. Research report, September 1983-August 1988 (Final).** Mounce, J.M.; Hawkins, H.G.; Stokes, R.W.; Payne, H.S. Texas A and M Univ., College Station, TX (USA). Texas Transportation Inst. Aug 1988. 197p. (TTI–2-10-84-339-14). Available from NTIS, PC A09/MF A01.

See also PB–87-168597.

Transitways are defined as exclusive, physically separated, access-controlled, high-occupancy vehicle priority treatment facilities which are typically located within existing freeway right(s)-of-way. Transitways are sometimes referred to as busways, high-occupancy vehicle (HOV) lanes, or authorized vehicle lanes (AVLs). The revised manual is divided into two parts: (1) Transitway mainlanes and connections; and (2) Transitway support facilities. Each of these parts addresses transitway planning, design, and operational considerations. Information presented within this transitway manual should promote effective planning, uniformity of design, and operational efficiency for transitway facilities in Texas.

2712 (PB–89-215479/XAB) **Urban Transportation Abstracts. Volume 7, 1988. Report for September 1988-February 1989.** Urban Mass Transportation Research Information Service, Washington, DC (USA). Apr 1989. 183p. (UMTA-DC–06-0610-88). Available from NTIS, PC A09/MF A01.

See also PB–89-170237. Library of Congress catalog card No. 83-640066.

Urban Transportation Abstracts is an annual publication that features abstracts and research project summaries on planning, designing, financing, constructing, operating, maintaining, managing, and marketing all modes of public transit. Some of these modes are advanced guideway systems, buses, carpools, commuter services, elderly and handicapped transport, heavy rail transit, light rail transit, paratransit, rapid transit, streetcars, taxicabs, trolley buses, and vanpools. Each issue is divided into five sections: (a) abstracts of reports and journal articles, (b) summaries of ongoing research, (c) a source index, (d) an author index, and (e) a subject index. This issue contains 712 abstracts of research reports, journal articles, and other information sources, and 105 summaries of ongoing research. Referenced documents come from both U.S. and foreign sources. The material is arranged according to the UMTRIS classification scheme; that is, abstracts and summaries are grouped by subject area, and within one subject area they are listed in ascending numerical order.

2713 (PB–89-215487/XAB) **HRIS (Highway Research Information Service) Abstracts. Volume 21, Number 4 - Winter 1988.** National Research Council, Washington, DC (USA). Transportation Research Board. 1988. 557p. Available from NTIS, PC A24/MF A01.

See also PB–89-170377. Library of Congress catalog card no. 75-642521.

HRIS Abstracts is a quarterly publication that provides information about highway and nonrail mass-transit research. It is compiled from computer records of the Highway Research Information Services (HRIS), an important subfile of the Transportation Research Information Services (TRIS) data base. The issue consists of four sections: Abstracts of research reports; Source Index listing names and addresses of corporate authors; Author Index; Retrieval Term Index listing subject terms for the HRIS Subject Terms List.

2714 (PB–89-218036/XAB) **Understanding the dynamics of innovation in urban transit. Final report on Phase 2.** Adler, S. Portland State Univ., OR (USA). Center for Transit Research and Management Development. Jun 1986. 86p. Available from NTIS, PC A05/MF A01.

See also PB–89-218028.

Urban transit is the major U.S. example of a once private industry that failed and was taken over by the public sector. Recent re-emergence of the private sector raises a number of issues and poses important policy questions. This report develops a conceptual model that explains the recent history of transit policy and outlines likely paths of transit service and institutional innovation. The model has 3 components: political and economic roles of transport facilities in the land-development process; nature of the political process through which transit became a public-sector activity; and politics of an industry whose prospects are the joint product of national, state, and local government activities. Each model element is explained, and their individual and collective implications for understanding recent policy history and likely future service and institutional changes are discussed. The report discusses the basic feature of the metropolitan development process, competition to maintain and attract capital investments.

2715 (PB–89-870885/XAB) **Hazardous-materials transportation. September 1982-September 1989 (Citations from the COMPENDEX data base). Report for September 1982-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 84p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868781.

This bibliography contains citations concerning the transportation of hazardous chemicals, gases, explosives, and spent nuclear fuel. Liquefied natural gas transportation is emphasized. Tanker ships, containers, and pipelines for these materials are discussed along with truck, rail, air, and submarine transportation. Safety programs and routing information are presented. Hazards specific to arctic shipping are included. (This updated bibliography contains 164 citations, 24 of which are new entries to the previous edition.)

3203 Industry and Agriculture

Refer also to citation(s) 2076, 2118, 2300, 2671, 2763, 2776, 2778, 2911, 3452, 3521, 3563, 3782

2716 (AD-A–210466/9/XAB) **Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska.** Hazardous Materials Technical Center, Rockville, MD (USA). Apr 1989. 89p. Available from NTIS, PC A05/MF A01.

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation-Restoration Program (IRP) Preliminary Assessment of Kalakaket Creek Radio Relay Station (RRS), Alaska. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous-material disposal sites on DoD facilities, control the migration of hazardous-contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. The major operations of the installation that used and disposed of hazardous materials/hazardous wastes (HM/HW) included vehicle maintenance; power production; petroleum, oils, and lubricants (POL) management; and management of batteries, electrical equipment, and paints. Small quantities of waste transformer fluid containing polychlorinated biphenyls (PCBs), lube oils, PD-680 solvent, synthetic oil, transmission fluid, motor gasoline, lead-acid batteries, fuel oil, aviation gasoline, diesel fuel, ethylene glycol, trichloroethane, paints, strippers, and thinners were generated by these activities. Asbestos was also used as a construction material

at the facility. At the time of the site visit, no evidence of contamination was visible at the RRS. However, as it was a common practice at similar facilities to bury drums and waste liquids, a landfill may exist in the vicinity of the RRS. In addition, asbestos was observed within the buildings at the RRS.

2717 (AD-A–210467/7/XAB) **Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska.** Hazardous Materials Technical Center, Rockville, MD (USA). Apr 1989. 130p. Available from NTIS, PC A07/MF A01.

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation Restoration Program (IRP) Preliminary Assessment of Bethel Radio Relay Station (RRS), Alaska. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DoD facilities, control the migration of hazardous-contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. Installation operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The major operations of the installation that used and disposed of HM/HW included radio relay, vehicle maintenance, and field maintenance fluids, and polychlorinated biphenyls (PCBs) were generated by these activities. The common practice at similar facilities was to bury these materials in a landfill, however, a landfill was not identified at Bethel RRS during the site visit. Asbestos, used as a construction material, was observed throughout a number of buildings at the RRS. Information obtained through six interviews and field observations indicates that HM/HW have been disposed of on the Bethel RRS property in the past at nine sites. Each of these sites is potentially contaminated with HM/HW and exhibit the potential for contaminant migration to groundwater and surface water.

2718 (AD-A–210468/5/XAB) **Installation-Restoration Program Preliminary Assessment, Naknek Recreational Camps, Alaska.** Hazardous Materials Technical Center, Rockville, MD (USA). Apr 1989. 91p. Available from NTIS, PC A05/MF A01.

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation-Restoration Program (IRP) Preliminary Assessment of Naknek Recreational Camps, Alaska, DoD policy is to identify and fully evaluate suspected problems associated with past hazardous-material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. Past installation operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The major operations of Naknek Camp I and Camp II did not use or dispose of HM/HW; however, these camps were used by the Air Force as dump areas and landfills. Waste oils, fuels, and polychlorinated biphenyls (PCBs) were among the wastes disposed of during these dumping activities. Information obtained through interviews, records, and field observations resulted in the identification of three sites that are potentially contaminated with HM/HW. At each of the identified sites, the potential exists for contamination of surface water, soils, and/or ground water and subsequent contaminant migration.

2719 (AD-A–210469/3/XAB) **Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska.** Hazardous Materials Technical Center, Rockville, MD (USA). Apr 1989. 88p. Available from NTIS, PC A05/MF A01.

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation-Restoration Program (IRP) Preliminary Assessment of Granite Mountain Radio Relay Station (RRS), Alaska; DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. The major operations of the installation that used and diposed of hazardous materials/hazardous waste (HM/HW) included management of fuel and electrical equipment, maintenance of the facility and vehicles, and use of asbestos as a construction material. Based on information obtained through interviews with Air Force personnel and review of installation records, hazardous materials were used at Granite Mountain RRS while the facility was in operation. Although no evidence of contamination was visible at the time of the site visit, it was common practice at similar facilities to bury drums and waste liquids and these wastes may be present in the solid-waste landfill at the RRS. In addition, asbestos may remain within the buildings.

2720 (AD-A–210470/1/XAB) **Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska.** Hazardous Materials Technical Center, Rockville, MD (USA). Apr 1989. 87p. Available from NTIS, PC A05/MF A01.

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation-Restoration Program (IRP) Preliminary Assessment of the Gold King Creek Radio Relay Station (RRS), Alaska; DoD policy is to identify and fully evaluate suspected problems associated with past hazardous-material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. The major operations of the installation that used and disposed of HM/HW included management of diesel fuel used to power the generators, management of lead-acid and nickel-cadmium batteries used to store electricity, handling of electrical equipment possibly containing polychlorinated biphenyls (PCBs), and use of asbestos as a construction material. Small quantities of hazardous materials were used at Gold King Creek RRS while the facility was in operation. The underground diesel tanks at the facility were drained and abandoned in place and the electrical equipment was removed from the site. No evidence of contamination was visible at the time of the site visit. However, asbestos may remain within the radio relay building, and information obtained through interviews and records resulted in the identification of one site at Gold King Creek RRS that is potentially contaminated with HM/HW.

2721 (AD-A–210471/9/XAB) **Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska.** Hazardous Materials Technical Center, Rockville, MD (USA). Apr 1989. 68p. Available from NTIS, PC A04/MF A01.

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation-Restoration Program (IRP) Preliminary Assessment of Bear Creek Relay Station (RRS) Alaska; DoD policy is to identify and fully evaluate suspected problems associated with past hazardous-material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. The major operations of the installation that used and disposed of hazardous materials/hazardous wastes (HM/HW) included automobile maintenance, storage of petroleum products, and communications. Types of hazardous wastes generated at the facility include residual fuels and oils, lead-acid storage batteries, and equipment containing polychlorinated biphenyls (PCBs). Asbestos was also used as a construction material at the facility. After the facility closed PCB-contaminated soil and equipment were removed from the site, as were batteries and fuels. No evidence of contamination was visible at the time of the site visit. However, as it was a common practice at similar facilities to bury drums and waste liquids, these wastes may present at the disposal site at the RRS. Liquid wastes may have also been disposed of into the floor drains of the vehicle maintenance shop; these drains may be connected to a dry well. In addition, asbestos may remain within the buildings.

2722 (AD-A–210472/7/XAB) **Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska.** Hazardous Materials Technical Center, Rockville, MD (USA). Apr 1989. 70p. Available from NTIS, PC A04/MF A01.

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation-Restoration Program (IRP) Preliminary Assessment of the Canyon Creek Radio Relay Station (RRS), Alaska, DoD policy is to identify and fully evaluate suspected problems associated with past hazardous-material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. Past installation operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The major operations of the installation that used and disposed of hazardous materials/hazardous wastes (HM/HW) included management

of diesel fuel used to power the generators, management of lead-acid and nickel-cadmium batteries, handling of electrical equipment possibly containing polychlorinated biphenyls (PCBs), and use of asbestos as a construction material. Information obtained through interviews, records, and field observations resulted in the identification of no sites at Canyon Creek RRS that are potentially contaminated with HM/HW. The underground diesel tanks were drained and properly abandoned and the batteries and electrical equipment were removed from the site. No evidence of contamination was visible at the time of the site visit. However, asbestos may remain within the radio relay building.

2723 (AD-A-210473/5/XAB) **Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska.** Hazardous Materials Technical Center, Rockville, MD (USA). Apr 1989. 83p. Available from NTIS, PC A05/MF A01.

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation-Restoration Program (IRP) Preliminary Assessment of Big Mountain Radio Relay Station (RRS), Alaska. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous-material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations. The major operations of the installation that used and disposed of hazardous materials/hazardous waste (HM/HW) included management of diesel fuel used to power the generators, management of lead-acid and nickel-cadmium batteries used to store electricity, use of asbestos as a construction material, and handling of electrical equipment possibly containing polychlorinated biphenyls (PCBs). Based on information obtained through interviews with Air Force personnel and installation records, small quantities of hazardous materials were used at the RRS while the facility was in operation. It is unknown if the above-ground fuel tanks at the facility were drained and properly abandoned in place. The electrical equipment has not been removed from the site. At the time of the site visit, no evidence of contamination was visible at the RRS, However, as it was common practice at similar facilities to bury drums and waste liquids, a landfill may exist in the vicinity of the RRS.

2724 (DOE/BP/35571-1) **Optimal real-time pump and irrigation scheduling for center-pivot sprinkler systems.** Chou, F.N.F.; Labadier, J.W.; Heermann, D.F.; Buchleiter, G.W. Colorado State Univ., Fort Collins, CO (USA). Sep 1988. 171p. Sponsored by U.S. Department of Agriculture; U.S. DOE Management & Administration. DOE Contract AI79-87BP35571. Order Number DE90002800. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Center-pivot farms located on major river systems generally pump water from the surface source and convey it through a pressurized pipe network to the pivots. Booster pump stations may be placed in the system to add necessary head for water delivery to the pivots. Attempts to improve pump and irrigation scheduling must make sure that soil moisture levels are maintained within desired limits for favorable crop growth. A soil water balance model and a branching pipe network hydraulics analysis model are therefore necessary for simulating system behavior and estimating pumping costs. The objective of this study is to develop a dynamic irrigation scheduling algorithm for achieving minimum pumping cost over a billing period, object to maintaining optimum crop production and adequate system delivery pressures. After investigation of several optimization methods, dynamic programming successive approximations (DPSA) is selected as the best approach to solving this problem. Feasibility in scheduling pivot operations and maintaining favorable soil water levels is always guaranteed during the DPSA analysis. Discrete dynamic programming is also applied for selecting pump combinations in each pump station with consideration of hydraulic interaction between stations to minimize pumping cost during each scheduling period for a specified irrigation strategy. A modified objective function is adopted for commensurating objectives of minimizing energy consumption and peak power demand. A comprehensive, generalized irrigation scheduling algorithm is developed to effectively integrate optimal irrigation decision with optimal pump selection. 116 refs.

2725 (DOE/CE/15407-T1) **Extended range tankless water heater: Quarterly report, April 19-July 19, 1989.** Harris, J.A. Harmony Thermal Co., Wichita, KS (USA). 26 Jul 1989. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-89CE15407. Order Number DE89016440. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This is the first quarterly report for the Extended Range Tankless Water Heater. The objective of this project is to develop an innovative gas-fired tankless water heater certified by AGA and ready for commercial sale. 8 figs.

2726 (EEO-ED-241/224) **Flux degassing of aluminium swarf and dross. A demonstration [at Birmal Components Ltd (Warley), Sarginson Bros Ltd (Coventry) and Cookson Precision Castings Ltd (London)].** Department of Energy, London (UK). Energy Efficiency Office; British Steel Corp., Rotherham (UK). Swinden Labs. Jan 1989. 38p. Order Number DE90718808.

Energy Efficiency Demonstration Scheme report for the Energy Technology Support Unit (ETSU), Harwell (GB).

A significant proportion of scrap produced in aluminium foundries consists of swarf, clippings and dross. These arisings, which may represent 10% of the weight of finished castings, are traditionally toll refined for secondary melting or sold. The extra energy required for melting and remelting this material compared with remelting bulk scrap in the foundry amounts to a national energy expenditure of approximately 7.5×10^5 GJ/annum at current production levels. Following the development and successful application of a flux injection process to remove simultaneously gas and inclusions from foundry melts, the technique has been applied to the cleaning and degassing of swarf remelted in-house. In-house processing offers advantages in that only one melting operation is involved in producing liquid metal, and yields obtainable are significantly higher than those normally produced by toll refining. Successful feasibility trials were undertaken in small indirectly-fired furnaces (basin tilting furnaces) at three foundries to assess the potential for the flux degassing of swarf, clippings and dross. The feasibility trials indicated that yields approaching 90% could be achieved for the melting of swarf, clippings and skimmings and that clean metal could be produced of castable quality. The process was generally environmentally acceptable, and easily incorporated into routine foundry practice. (author).

2727 (EGG-M-36387) **Field testing of a ceramic heat exchanger for heat recovery application.** Sohal, M.S. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 29p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570;FC07-81ID12170. (CONF-880724-29: 25. American Society of Mechanical Engineers/American Institute of Chemical Engineers/American Nuclear Society national heat transfer conference, Houston, TX (USA), 24-27 Jul 1988). Order Number DE90002082. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

AiResearch Company, Torrance, California, developed a 5 MMBtu/hr ceramic-metallic hybrid High Temperature Burner-Duct-Recuperator (HTBDR) system to recover energy from hot (up to 2500°F), dirty, and corrosive glue gas streams and preheat combustion air up to 2000°F. To reduce the cost and size of the ceramic recuperator, ceramic tubes with internal cruciform baffles were developed. The HTBDR system was tested on a 20 MMBtu/hr rotary forging furnace for about 2000 hours. To facilitate tube replacements, final design configuration uses horizontally mounted tubes. A maximum air preheat temperature of about 1916°F was achieved with a flue gas temperature of 2122°F. This represents fuel savings of about 30 to 50 percent (depending upon the amount of excess air) compared with an unrecuperated furnace. The overall design and operation of the recuperator proved to be successful up to the time of material failure. X-ray diffraction of some failed components indicated that there was some residual Silicon in the interior regions and complete nitriding did not occur during the fabrication process. Degradation of failed components was probably caused by oxidation of residual Silicon and by the stresses caused due to different coefficient of thermal expansion of various compounds during thermal cycling. A combination of severe and numerous thermal cycling coupled with incomplete nitriding was the most likely cause of material failure. 22 refs., 12 figs., 4 tabs.

2728 (EGG-M–89322) **Membrane applications in the food industry: Survey and barriers.** Leeper, S.A.; Mohr, C.M.; Engelgau, D.E.; Charboneau, B.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 11p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-8910272–1: 7. annual membrane technology/planning conference, Cambridge, MA (USA), 17-19 Oct 1989). Order Number DE90002042. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Idaho National Engineering Laboratory (INEL), with the support and assistance of the US Department of Energy, Office of Industrial Programs (DOE-OIP), conducted a comprehensive assessment of membrane applications in the food industry. In the course of preparing the assessment, over 70 existing, developing, and potential membrane technology applications in the food industry were identified. In addition, barriers to expanded use of membrane technology in the food industry were identified for the purpose of defining future DOE-OIP research directions. In this paper, commercial, developing, and conceptual membrane applications in the food industry are briefly summarized and barriers to expanded use of membrane technology in the food industry are identified and discussed. 2 refs., 9 tabs.

2729 (ETDE-mf–0717921) **Desulfurization of industrial gaseous effluents. Final report.** Onken, U. Dortmund Univ. (Germany, F.R.). Lehrstuhl fuer Technische Chemie B. [1989]. 71p. (In German). KZ 01 VQ 163. Order Number DE90717921. Available from NTIS (US Sales Only), PC A04/MF A01.

The method worked out here in detail is based on the formation of CuS by introducing H_2S-containing gases into an aqueous $CuSO_4$ solution. The metal sulfide is oxidized into sulfate by the thiobacillus ferrooxidans microorganism under aerobic conditions. Sulfuric acid is developed as a final product. It has proved to be necessary to carry out the CuS precipitation and the bacterial oxidation in separate reactors. Starting out from an H_2S concentration of 1 g/m^3, it is, according to the laboratory investigations, possible to attain a waste reaction gas of $C_{H2S} < 1$ mg/m^3 with a reaction volume of 10 m^3 and a waste gas flow rate of 1.000 m^3/h. From the economic point of view the process could be interesting for the purification of synthesis gas. In this respect the service life of the catalysts and thus the production price could be improved. (RB).

2730 (ETDE-mf–0721937) **Investigations on combined deposition of particulate and gaseous pollutants in a packed bed filter at high temperatures.** Peukert, W. Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Mechanische Verfahrenstechnik und Mechanik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). [1988]. 129p. (In German). Order Number DE90721937. Available from NTIS (US Sales Only), PC A07/MF A01.

The aim of the research project was to determine the physical and chemical fundamentals of the combined deposition of dust and gaseous pollutants in a packed bed filter. For this purpose a novel approach has been chosen, with systematic measurements at room temperature being done in order to determine the separation efficiency for particle sizes between 0.01 μm and 10 μm as a function of significant filtration parameters. From the broad spectrum of parameter variations applied, measured results show the optimal conditions for the required particle deposition, and it is expected that the results can be applied to high temperatures as well. For the examinations in dependence on the temperature, a process development plant has been built which can be operated by temperatures of up to 800^{0}C. The examinations on the sorption of gaseous pollutants showed that packed bed filters can also be efficiently used for the separation of noxious gases. Though only raw, comparatively inert limestone was used as model substance conversion degrees of up to 90% for the separation of hydrogen chloride and up to 45% for the sorption of sulphur dioxide could be achieved. First formulations for the theoretical description of the break-through curves have been set up. It became evident that the extremely complex correlations of the sorption process can in principle be approximately precalculated even with comparatively simple kinetic formulations. (orig./RB).

2731 (ETDE-mf–0722264) **Options and techniques for enhanced waste heat recovery in small- and medium-sized enterprises. A guideline.** Verein Deutscher Ingenieure (VDI) - Gesellschaft Energietechnik, Duesseldorf (Germany, F.R.); Vereinigung Industrielle Kraftwirtschaft (VIK) e.V., Essen (Germany, F.R.); Forschungsstelle fuer Energiewirtschaft, Muenchen (Germany, F.R.); Fernwaerme-Forschungsinstitut in Hannover e.V., Hemmingen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Sep 1988. 129p. (In German). Order Number DE90722264. Available from NTIS (US Sales Only), PC A07/MF A01.

Among the available waste heat recovery processes today are heat exchangers, heat pumps, ORC plants, vapour compressors, and heat transformers. External use of the recovered waste heat may interfere with the plant's operating regime and is therefore considered problematic. Internal waste heat recovery, on the other hand, is already practiced in a number of cases, as is external waste heat utilisation. The guideline presents techniques, methods of implementation, and practical decision aids for small and medium-sized enterprises who are interested in a technically feasible and economically efficient waste heat utilisation. (BR).

2732 (ETSU-R–48) **Process integration initiative. A review of the process integration activities funded under the Energy Efficiency R and D programme.** Brown, K.J. Energy Technology Support Unit, Harwell (UK). Jul 1989. 78p. Order Number DE90722715. Available from NTIS (US Sales Only), PC A05.

A review is given of the UK Dept. of Energy's involvement in the thermodynamic technique known as process integration. It has been applied across a wide range of industrial sectors and 26 feasibility studies have been performed. By the end of 1988, a total of Pound 24 million per annum of energy savings had been identified and some 47% of these had been implemented. As a result of the publicity surrounding these studies, a further Pound 30 million per annum of energy savings have been stimulated. An assessment for future involvement with the technique is proposed. (UK).

2733 (NEI-DK–213) **Energy efficient method for evaporating concentrated aqueous solutions of temperature sensitive substances. Phase 1.** Elefsen, F.; Pedersen, K. Jysk Teknologisk, Aarhus (Denmark). Energiteknik. Jun 1989. 69p. (In Danish). Order Number DE90718982. Available from NTIS (US Sales Only), PC A04/MF A01.

EFP-87.

In the present project a new method for evaporating temperature sensitive substances has been investigated. The evaporation takes place in a vacuum on hallow plastic balls containing a heat conductor, that has an alternation of phases at a temperature of 56 deg. C. The balls circulate in a closed cycle at two different pressure levels. An evaporator pressure corresponding to the pressure of saturated aqueous vapour at 46 deg. C., and a condenser pressure corresponding to the pressure of aqueous vapour at 66 deg. C. The pressure difference between the evaporator and the condenser is produced by means of an aqueous vapour compressor. The method of evaporation is patented by Jysk Teknologisk. (SH) 11 refs.

2734 (NEI-DK–216) **Diesel-driven heat pump applied to grain drying and chilling. Phase 2.** Energiministeriets Forskningsprogram 1986. Industrielle processer og apparater. Elefsen, F. Jysk Teknologisk, Aarhus (Denmark). Energiteknik. Sep 1989. 54p. (In Danish). Order Number DE90719030. Available from NTIS (US Sales Only), PC A04/MF A01.

Energiministeriets Forskningsprogram 1986. Industrielle processer og apparater.; EFP-86.

A test plant, based on a computer model developed in an earlier project, was built in order to investigate operation and energy economy. It consists of a continuous flow dryer with a capacity of 20000 kg/h and a diesel-driven heat pump which has an 8 cylinder R12 and a 6 cylinder R22 piston compressor. The motor is a 6 cylinder diesel engine with a gross power of 190 kW. Two sets of mesurements were performed in the harvest seasons of 1987 and 1988. The computer model developed in the earlier project was corrected to fit with the performed measurements. The corrected model is used to make new simulations in different working conditions. Energy saving are 50-55% more than that achieved in plants without a heat pump. The considerable amount of dust on the heat exchangers must be taken into acount. The plant must be reliable. A lot of grain can be damaged if the plant breaks down in the working period. Plants of this type must be provided with indirect evaporators

and condensers to achieve a reliable operation. In this way you can test the refrigeration system before installation. Especially in developing countries this fact is very important. (AB).

2735 (NEI-DK–227) **Water hyacinth horticulture management of manure.** Crone og Koch Raadgivende Ingenioerfirma K/S, Viborg (Denmark). Sep 1988. 111p. (In Danish). Order Number DE90719294. Available from NTIS (US Sales Only), PC A06/MF A01.

When water hyacinths are cultivated in greenhouses in solutions of manure, the plants' transpiration induces water evaporation of the manure which consequently reduces its volume. Thus a method of storing manure for use in future fertilization of crops is achieved. At the same time the plants are fertilized and can be subsequently utilized as animal fodder which will be very rich in protein. The process also results in significant energy conservation in the horticultural application. This combination of processes, and methods for producing them, as well as possible future applications, are described in detail and illustrated by graphs and diagrams. (AB) 42 refs.

2736 (PB–89-218796/XAB) **Steam stripping and batch distillation for the removal/recovery of volatile organic compounds.** Hassan, S.Q.; Herrin, J.P. Cincinnati Univ., OH (USA). Dept. of Civil and Environmental Engineering. 1989. 16p. Available from NTIS, PC A03/MF A01.

Steam stripping and batch distillation are two techniques under investigation by the Hazardous Waste Treatment Branch of the USEPA Risk Reduction Engineering Laboratory. The studies evaluated the application of these methods to aqueous and dilute organic solutions which are currently subject to land-disposal restrictions. General design equations which can be used to assess the applicability of steam stripping to achieve a given separation are included. Preliminary results of a pilot-scale steam stripping study with 2-nitropropane are reviewed. General design procedures for batch distillation are also discussed.

2737 (PB–89-222277/XAB) **Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Wood-treating industries.** Science Applications International Corp., Bellevue, WA (USA). Jun 1988. 41p. Available from NTIS, PC A03/MF A01.

This Resource Conservation and Recovery Act (RCRA) Handbook was developed for pentachlorophenol and chromated copper arsenate wood-treating businesses to assist them in complying with pertinent sections of the requirements. Described are facility operations and the wastes generated as a result of them; the hazardous wastes generated and the RCRA regulations that specifically apply to them; the RCRA generator requirements; and hazardous and non-hazardous waste management strategies for minimizing waste generation and handling waste. Appendices provide: information regarding the acute and toxic commercial chemical products and wastes (F, P, and U wastes); the procedures for identifying characteristic hazardous wastes in wood-treating facilities; and a list of references and contacts for obtaining additional information about hazardous wastes and their regulation.

2738 (PB–89-222285/XAB) **Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Printing and publishing.** Science Applications International Corp., Bellevue, WA (USA). Jun 1988. 50p. Available from NTIS, PC A03/MF A01.

This Resource Conservation and Recovery Act (RCRA) Handbook was developed for the printing and publishing industries to provide assistance in complying with pertinent sections of the RCRA requirements. Printing operations are summarized and the characteristics of wastes generated and general waste-management practices are described. How these waste types may be subject to the RCRA and Administrative Rules of Montana regulations based on how they are managed and on their specific characteristics is outlined. The RCRA generator requirements are discussed, while waste-management strategies for minimizing the amount of hazardous waste generated by printing businesses are described. Appendix A is a listing of acute and toxic hazardous wastes used for regulatory purposes (F, P, and U wastes). Appendix B provides a summary of RCRA characteristic wastes. Appendix C contains a list of references and contacts for obtaining more information about hazardous wastes and their regulation.

2739 (PB–89-222319/XAB) **Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Dry cleaners and commercial laundries.** Science Applications International Corp., Bellevue, WA (USA). Jun 1988. 40p. Available from NTIS, PC A03/MF A01.

This Resource Conservation and Recovery Act (RCRA) Handbook was developed for businesses involved in dry cleaning and commercial laundering to provide assistance in complying with pertinent sections of the RCRA requirements. Dry-cleaning operations are summarized and the characteristics of wastes generated and general waste management practices are described. How these waste types may be subject to the RCRA and Administrative Rules of Montana regulations based on how they are managed and on their specific characteristics is outlined. The RCRA generator requirements are discussed, while waste-management strategies for minimizing the amount of hazardous waste generated by dry cleaners and laundries are described. Appendix A lists RCRA acute and toxic hazardous wastes (F, P, and U wastes). Appendix B provides a summary of RCRA characteristic wastes. Appendix C lists references and contacts for obtaining more information about hazardous wastes and their regulation.

2740 (PB–89-222327/XAB) **Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Analytical laboratories.** Science Applications International Corp., Bellevue, WA (USA). Jun 1988. 43p. Available from NTIS, PC A03/MF A01.

This Resource Conservation and Recovery Act (RCRA) Handbook was developed for analytical and clinical laboratories to provide assistance in complying with pertinent sections of the RCRA requirements. Laboratory operations are summarized and the characteristics of wastes generated and general waste management practices are described. How these waste types may be subject to the RCRA and Administrative Rules of Montana regulations based on how they are managed and on their specific characteristics is outlined. The RCRA generator requirements are discussed, while waste-management strategies for minimizing the amount of hazardous waste generated by laboratories are described. Appendix A is a listing of acute and toxic hazardous wastes (F, P, and U wastes) used for regulatory purposes. Appendix B provides a summary of RCRA characteristic wastes. Appendix C contains a list of references and contacts for obtaining more information about hazardous wastes and their regulation.

2741 (PB–89-222590/XAB) **Recovery of metals using aluminum displacement.** Meyers, S.C. Circuit Chemistry Corp., Maple Plain, MN (USA). Jun 1988. 35p. Available from NTIS, PC A03/MF A01.

This report documents a project to recover metals from metal-finishing waste streams using aluminum displacement as a pretreatment process rather than the standard pretreatment process of removing metals from the effluent before discharge, resulting in a sludge that must be disposed of as hazardous waste. The project found that a single pass through aluminum-exchange reactors resulted in 85% or more of the metals being removed from the waste stream.

2742 (PB–89-222814/XAB) **Waste-minimization insights for the polymer industry.** Howell, S.G.; Randall, P.M. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1989. 11p. (EPA–600/D-89/085). Available from NTIS, PC A03/MF A01.

The huge volumes of polymeric materials produced in this country can also result in the production of large volumes of wastes consisting of off spec polymers, process solvents, additives, stabilizers, and gaseous emissions. The EPA has recently instituted an effort to work with the industry to minimize these wastes, which will not only result in lower pollution, but if properly thought out and instituted, result in cost savings. Economic pressures have always been a tremendous incentive to minimize waste and maximize production. The authors suggest that a joint industry/EPA program be set up to accomplish this and offer some suggestions on areas in which to start.

2743 (PB–89-223663/XAB) **Incinerability index: A measure of incinerator performance.** Thurnau, R.C. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. May 1989. 24p. (EPA–600/D-89/081). Available from NTIS, PC A03/MF A01.

Since promulgation of the hazardous-waste incinerator performance standards in January 1981, there has been a continuing interest in validating a real-time surrogate means of measuring incinerator compliance with the destruction and removal efficiency (DRE) performance standard. One such possible surrogate is sulfur hexafluoride (SF_6). SF_6 is one of the most stable compounds known with respect to thermal decomposition. Thus, it has been hypothesized that the SF_6 DRE would represent a lower bound to other principal organic hazardous constituent DREs in an incinerator. Further, SF_6 can be measured at very low concentrations in flue gas on a real-time basis using onsite gas-chromatographic techniques. Thus, use of SF_6 injection with real-time DRE measurement represents a potentially attractive surrogate DRE measure for determining continuous compliance with the DRE performance standard.

2744 (PB–89-224075/XAB) **Waste audit study: Automotive paint shops.** SCS Engineers, Inc., Long Beach, CA (USA). Jan 1987. 108p. Available from NTIS, PC A06/MF A01.

See also PB–89-224083.

This report presents the results of a waste-audit study of automotive paint shops. The study focuses on the types and quantities of wastes generated, treatment and disposal alternatives, and the potential for reducing the amount and/or toxicity of waste generated. The analysis of solvent waste minimization focused primarily on in-plant modifications (e.g., source reduction) to reduce the generation of solvent waste. Strict inventory control is the most-readily implementable approach. While in-house recycling is viable, it is usually only cost-effective for larger firms. Specific recommendations for waste reduction were made.

2745 (PB–89-224109/XAB) **Wisconsin waste reduction and recovery plan.** Reindl, J. Wisconsin Dept. of Natural Resources, Madison, WI (USA). Bureau of Solid Waste Management. Feb 1986. 78p. Available from NTIS, PC A05/MF A01.

This plan sets goals and strategies to reduce further the amount of waste being landfilled by promoting the reduction of the quantity of waste generated, the reuse, recycling, and composting of materials; and the recovery of energy from waste. The document comes up with an action plan for implementation and includes appendices of waste quantities and composition calculations; technologies for alternative waste reduction, recycling, and recovery; state statutes and administrative codes; and a bibliography of the Department of Natural Resources' publications on recycling.

2746 (PB–89-224117/XAB) **Waste audit study: Research and educational institutions.** Stone (Ralph) and Co., Inc., Los Angeles, CA (USA). 15 Aug 1988. 152p. Available from NTIS, PC A08/MF A01.

This document reports on hazardous-waste reduction audits performed at three diverse research/educational institutions in southern California. Waste-reduction opportunities identified include: utilizing microscale experiments; chemical substitution; treating waste chemicals in the final step in experiments; and recycle, recovery, and treatment options. A generic self-audit was developed for use by educational and research institutions throughout the state.

2747 (PB–89-224729/XAB) **Evaluation of emission sources from creosote wood-treatment operations. Final report.** Vaught, C.C.; Nicholson, R.L. Midwest Research Inst., Cary, NC (USA). Jun 1989. 88p. Available from NTIS, PC A05/MF A01.

This document discusses each of the preservatives and the processes used to treat a variety of wood products, concentrating on the use of creosote for the treatment of crossties. Of particular concern are the emission sources associated with the release of odor and air toxics and the technologies currently in use to control them.

2748 (PB–89-224786/XAB) **Reduction of arsenic wastes in the electronics industry (application to study). Final report.** Envirosphere Co., Santa Ana, CA (USA). Jun 1987. 115p. Available from NTIS, PC A06/MF A01.

This publication is the final report of a group studying the reduction of arsenic wastes in the electronics industry. They used the gallium arsenide (GaAs) chip manufacturing process at the Hewlett-Packard Company's San Jose facility as a model. The study found that ingot grinding and slicing produced approximately 90% of all arsenic waste. They also discovered that 95% of arsenic waste existed in the particulate form. These findings indicated that a filter in combination with a filter press could recover the vast majority of arsenic from the waste-water stream. In addition to recovering a valuable product (GaAs), the arsenic waste currently transported as an extremely hazardous waste to a class I landfill would be reduced by greater than 95%.

2749 (PB–89-224794/XAB) **Reduction of solvent wastes in the electronics industry. Waste reduction grant program. Final report.** Envirosphere Co., Santa Ana, CA (USA). Jun 1988. 97p. Available from NTIS, PC A05/MF A01.

The microelectronics component manufacturing processes at Hewlett Packard's San Jose facility were used as a model to study the techniques required to reduce the volume and type of organic-solvent wastes in the electronics industry. Although organic-solvent wastes are produced from numerous complex wafer fabrication steps, the volume and type of solvents utilized in each step were documented and evaluated for waste reduction. This study indicates that up to a 70% reduction in organic-solvent waste volume at the facility could be realized. This represents a potential cost savings to Hewlett Packard of up to $414,000 per year in disposal costs and chemical-purchase costs. The findings of this study indicate that solvent segregation, solvent substitution, direct solvent reuse, and distillation/evaporation are the primary solvent-handling processes that could be utilized to accomplish this reduction.

2750 (PB–89-225254/XAB) **Safe disposal of hazardous wastes: The special needs and problems of developing countries. Volume 1-Volume 3. World Bank technical paper.** Batstone, R.; Smith, J.E.; Wilson, D. International Bank for Reconstruction and Development, Washington, DC (USA). 1989. 845p. (WORLD-BANK-TP–93). Available from NTISMF E04.

Library of Congress catalog card no. 89-5670; Microfiche copies only. Paper copy available from World Bank, 1818 H. St., NW, Washington, DC 20433.

The World Bank, World Health Organization, and United Nations Environment Program have cooperated in the preparation and issuance of The Safe Disposal of Hazardous Wastes. The three-volume manual is intended for administrators and technical staff, primarily in developing countries, who have responsibilities for waste management, public health and environmental protection. Information presented in the publication includes the classification of hazardous-waste, its effects on health and the environment, the planning and implementation of programs in hazardous waste management, hazardous-waste treatment, and disposal technologies, including economic and institutional considerations. The main emphasis of the manual is on the management aspects and on the technologies that may be appropriate for implementing a region-wide hazardous-waste management program.

2751 (PB–89-871123/XAB) **Wastepaper recycling. January 1976-September 1989 (Citations from the Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 149p. Available from NTISPC N01/MF N01.

Supersedes PB–86-862687.

This bibliography contains citations concerning the recycling of waste-paper fibers for the production of new paper products. The development of the recycling industry; flotation processes; recycled fiber properties and improvement methods; and the installation, operation, and maintenance of paper-recycling systems are among the topics discussed. Applications, markets, economics, regulations, production statistics, and waste-paper salvaging are considered. De-inking of waste paper is examined in a separate bibliography. (This updated bibliography contains 249 citations, 42 of which are new entries to the previous edition.)

2752 (PB–89-871248/XAB) **Pulping effluents: Biological treatment. January 1976-September 1989 (Citations from the**

Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989. National Technical Information Service, Springfield, VA (USA). Sep 1989. 35p. Available from NTISPC N01/MF N01.

Supersedes PB-86-871936.

This bibliography contains citations concerning effluent and wastewater biological treatment and disposal in the pulping industry. Effluent toxicity; treatment plant management, treatment systems and equipment design; combined mechanical and biological treatment processes; biological degradation treatment in chemical pulp mills; and the handling and disposal of solid wastes are among the topics discussed. Performance evaluations of biological treatment processes in domestic and foreign plants in full scale operation and pilot programs are considered. (This updated bibliography contains 48 citations, 10 of which are new entries to the previous edition.)

2753 (PNL-SA-16968) **Back to basics.** Ruffin, J.E. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8909110-9: 16. annual conference of the American Society for Quality Control, Fort Lauderdale, FL (USA), 17-20 Sep 1989). Order Number DE90002734. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Quality control/quality assurance controls were originally developed and selected for application because they were effective in preventing, reducing, or detecting specific problems that were occurring in manufacturing processes. With the development and use of quality assurance program standards, there has been a movement toward determining the requirements of a quality program standard that are "applicable" to a certain process as the starting point in the determination of the QA controls to be applied. This paper discussed the advantages of reviewing and addressing the problems, past or potential, associated with a process as the initial step in the QA control determination.

2754 (SVF-341) **Energy management.** Ahlstroem, M.; Normark, P.; Qvist, B. Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden). May 1989. 68p. (In Swedish). Order Number DE90719411. Available from NTIS (US Sales Only), PC A04/MF A01.

To begin with a number of basic definitions and delimitations; in particular, the definitions for Energy Control and Energy Management System (EMS) are scrutinized. Commercially available industrial EMS-systems are dealt with, their configurations discussed and commented on and an attempt is made to systemize the functions of commercial EMS-systems for industrial applications. The important interaction between EMS-systems and industrial process control systems is examined from the viewpoint of system engineering and operational safety and in terms of performance and system capability. In a similar manner commercially available EMS-systems for HVAC-applications are discussed. In the two last chapters of the paper the EMS-systems as money makers in industrial as well as HVAC-applications are discussed.

2755 (VTT-TUTK-621) **Frost resistance of concrete in artic offshore structures.** Leivo, M. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1989. 142p. (In Finnish). Order Number DE90719344. Available from NTIS (US Sales Only), PC A07/MF A01.

In the literature part of this work the nature of frost attack in arctic offshore conditions is studied and reguirements for concrete according to literature in arctic offshore conditions are presented. Frost action has been examined theoretically. In the theoretical examinations the hydraulic pressure theory and the capillary ice lens segregation theory are studied. Both theories are applied to arctic offshore conditions. The aim of the experiments was to examine the effects of the pore structure on the frost resistance under an arctic freezing and thawing attack. Freezing and thawing resistance was tested with a new test method developed at VTT. Specimens were submerged in sea water and subjected to repeated freezing at the temperature of -55 deg C and thawing at +20 deg C. The pore structure of hardened concrete was determined by optical air pore analysis. Capillary water absorption test and protective pore ratio test were performed as well. The pore structure of each binder type was measured with the mercury intrusion porosimeter. On the basis of the test results the criteria for ensuring the frost resistance are given.

2756 (WSRC-tr-122) **Mixing times during the stirring of gas-charged viscous liquids (Part 3).** (Mischzeiten beim ruhren von begasten viskosen flussig-keiten (3. Teil)). Stein, W.A. 7p. Translated from Chemie-Ingenieur-Technik (F.R. Germany). *Chemie-Ingenieur-Technik (F.R. Germany),* 60(10): 792-793 (1988). Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035.

This report is the third part of an investigation of mixing times during the stirring of gas-charged viscous liquids. Topics covered are: mixing time in the bubble column; stirring power with the paddle agitator; mixing time with the blade agitator; expansion of the mixing model by a third limiting low; and comparison between blade agitator, cross blade agitator and screw spindle agitator.

2757 (WSRC-tr-123) **Studies of the homogenization of structurally viscous and viscoelastic liquids in stirring containers.** (Untersuchungen zur homogenisierung strukturviskoser und viskoelastischer flussigkeiten in ruhrbehaltern). Poertner, R.; Werner, U. 5p. Translated from Chemie-Ingenieur-Technik (F.R. Germany). *Chemie-Ingenieur-Technik (F.R. Germany),* 61(1): 72-73 (1989). Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035.

This report briefly reviews homogenization processes in stirring reactors for viscous and viscoelastic liquids. Until now a detailed description of the processes occurring in non-Newtonian fluids has been missing. For stirring devices which are ordinarily used in the laminar-turbulent transition range the mixing time characteristics were determined for Newtonian glucose and non-Newtonian CMC and PAA solutions. 4 refs. (JDL)

3206 Municipalities and Community Systems

Refer also to citation(s) 2132, 2590, 2743, 2745, 2750, 3041, 3440, 3444, 3547

2758 (ANL/PPRNT-89-188) **Evaluation of fuel cell technologies for electric utility applications.** Minkov, V.; Krumpelt, M.; Daniels, E.K.; Asbury, J.G.; Zeh, C.M. Argonne National Lab., IL (USA). 1989. 14p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. Order Number DE90002996. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this article is to discuss the applicability of baseload fuel cell systems to electric utilities by comparing the technical and economic performance of contemporary power systems, such as the combined cycle and pulverized coal plants, to the performance of "traditional" and optimized fuel cell systems. Before going into the substance of that discussion, the fuel cell technology is briefly described. 6 refs., 5 figs., 4 tabs.

2759 (CONF-8908177-1) **Regional application of natural-gas-fired combined-cycle power generation.** Poch, L.A.; Gillette, J.L.; Hedman, B.A. Argonne National Lab., IL (USA). [1989]. 6p. Sponsored by Gas Research Institute. DOE Contract W-31109-ENG-38. From 24. intersociety energy conversion engineering conference; Washington, DC (USA); 6-11 Aug 1989. Order Number DE90001769. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The results of a study assessing natural-gas-fired combined-cycle (GFCC) power generation in the electric-utility sector are presented. This study quantified the economic benefits attributable to GFCC generation and examined the characteristics of GFCC technology that produce these benefits and the ways that these benefits vary among regions in the country. The impacts of changes in important economic parameters (capital cost, fuel price, etc.) as well as the impact of advances in GFCC technology were considered. Use of GFCC technology in the electric-utility sector could play an important role in a least-cost planning strategy and thereby provide significant benefits to the utilities and their customers. Potential benefits include reduced capital and operating costs, more effective matching of load growth and capacity additions, and greater system reliability. 8 refs., 3 tabs.

2760 (ETDE-mf–0721946) **Rationalization of aerobic-thermophilic stabilisation by means of raw sludge dehydration.** Poepel, H.J.; Bau, K.; Glasenapp, J. Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Wasserversorgung, Abwasserbeseitigung und Raumplanung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Dec 1988. 291p. (In German). Contract BMFT 02-WS 411/4. Order Number DE90721946. Available from NTIS (US Sales Only), PC A13/MF A01.

These investigation results show that, by means of aerobic-thermophilic stabilization, perfect stabilization results can be achieved throughout the year with simultaneous decontamination (with stay periods of 4 to 5 days) if the crude sludge first is mechanically thickened to TR contents of up to 8 percent. The precondition for this is the perfect adaptation of aeration and mixing to the higher substrate concentration of the mechanically thickened crude sludges. (orig./EF).

2761 (NEI-DK–229) **District heating connections with high consumption.** Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme. Bryder, K.L.; Munk Pedersen, J. Jysk Teknologisk, Aarhus (Denmark); Cowiconsult Raadgivende Ingenioerer A/S, Virum (Denmark). Jul 1989. 312p. (In Danish). Order Number DE90719301. Available from NTIS (US Sales Only), PC A14/MF A01.

Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme.; EFP-86. Related to EM-1413/86-8; Forsidetitel: Storborbrugerens installationer.

The object was to demonstrate the reasons why large heat consuming installations cause wasteful energy generation and uneconomic overall operational running of most district heating plants. The paper includes descriptions and analyses of 36 typical installations including tests and proposals for improvements within installations, a catalogue on large heat consuming installations and, instructions for operational control of connections by large heat consuming installations. Factors influencing uneconomic operation because of large-scale consumers. Poor cooling of the district heating water, e.g. less than 30 deg. C.. The fact that higher temperatures are required than for small-scale consumers, e.g. more than 80 deg. C and that high differential pressure is necessary e.g. more than 0.5 bar. Also, consumption varies a great deal, e.g. due to oscillating automatic control equpment. 10 district heating supply plants representing a range of different categories of buildings and connections and types of installations were surveyed. Reasons for unsatisfactory operational conditions were poor temperature regulation and inappropriate shunts (e.g. double shunting), water supply mains inappropriately connected and faults in automatic control equipment. District heating plants managers should to put pressure on large heat consumers by regular supervision of operational conditions at the relevant large heat consuming installation, focusing on cooling, installation of control equipment to limite the minimum cooling of the water, e.g. to more than 30 deg. C and economic sanctions in the form of, e.g., imposing charges where the cooling is less than 30 deg. C. (AB).

2762 (NEI-DK–230) **Utilization of computerized control for optimization of energy systems.** Innosys ApS, Copenhagen (Denmark). Feb 1989. 46p. (In Danish). Order Number DE90719311. Available from NTIS (US Sales Only), PC A03/MF A01.

Methods of building up a computer program which can be used for the operational control of district heating or local power plants and in this way achieve optimal operational efficiency. (AB).

2763 (PB–89-221360/XAB) **Trial burns: methods perspective.** Johnson, L.D. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab. Feb 1989. 13p. (EPA–600/D-89/043). Available from NTIS, PC A03/MF A01.

When conducting a trial burn, it is necessary to make a number of measurements to adequately define the performance of the incinerator. In addition to flue-gas emissions for particulate matter, HCl, and selected organics, it is also necessary to measure selected organics in the waste feed, incinerator operating temperature, stack gas volume flow, waste feed rate, and many other important parameters. A relatively small, but important segment of this trial burn sampling and analysis universe is addressed in this paper. The sampling and analysis procedures receiving the most attention until recently have been those for organic compounds. The knowledge base and availability of detailed procedures is still expanding. Recently, concerns about metals emissions have caused further research into sampling technology in that area. Accordingly, the principal sampling and related analytical methods discussed are Method 0010, Method 0030, and the new Multiple Metals Train.

2764 (PB–89-221410/XAB) **Treatment technology background document.** Berlow, J.R.; Vorbach, J. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. Jun 1989. 253p. (EPA–530/SW-89/048A). Available from NTIS, PC A12/MF A01.

This document, consisting of descriptions of 23 treatment technologies, includes information relevant to the use and understanding of the background documents for each group of listed hazardous wastes subject to the RCRA Land Ban restrictions. These treatment technology descriptions represent a revision to previously published versions. Typically, the revisions made were editorial in nature. The reader should note that the document has not been peer reviewed.

2765 (PB–89-221428/XAB) **Methodology for developing best demonstrated available technology (BDAT) treatment standards.** April, R. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1989. 81p. (EPA–530/SW-89/048B). Available from NTIS, PC A05/MF A01.

See also PB–89-221410 and PB–89-142301.

This document summarizes EPA's approach for implementing the land-disposal restrictions program. Section 2 presents the legal authority under which the Agency is basing its regulations; Section 3 describes the technical methodology EPA uses to define treatment standards for restricted hazardous wastes. Section 4 discusses variances from these treatment standards, and finally, Section 5 presents the Agency's approach to the special problems raised by the P and U listed hazardous-waste categories in 40 CFR 261.33.

2766 (PB–89-221444/XAB) **Best demonstrated available technology (BDAT) background document for organophosphorous wastes.** April, R.; Cunningham, M. Versar, Inc., Springfield, VA (USA). Jun 1989. 62p. Available from NTIS, PC A04/MF A01.

See also PB–89-142251 and PB–89-221428.

This background document provides the Agency's technical support for selecting and developing treatment standards for the constituents to be regulated in these organophosphorous wastes. Section 2 presents waste-specific information; Section 3 discusses the applicable and demonstrated technologies used to treat these wastes; Section 4 presents the available performance data; Section 5 explains EPA's determination of BDAT, while Section 6 discusses the selection of constituents to be regulated, and Section 7 presents treatment standards for these constituents.

2767 (PB–89-221451/XAB) **Best demonstrated available technology (BDAT) background document for phthalate wastes.** April, R.; Rosengrant, L. Versar, Inc., Springfield, VA (USA). Jun 1989. 55p. Available from NTIS, PC A04/MF A01.

See also PB–89-142244 and PB–89-221444.

This document provides the Agency's technical support for selecting and developing treatment standards for the constituents to be regulated in the phthalate wastes. Sections 2 through 7 present waste-specific information for the K023, K093, and K094 wastes. Section 8 presents a discussion of the development of treatment standards for those phthalate wastes designed as U wastes (U028, U069, U088, U102, U107, and U190).

2768 (PB–89-221469/XAB) **Best demonstrated available technology (BDAT) background document for K009 and K010.** April, R.; Labiosa, J. Versar, Inc., Springfield, VA (USA). Jun 1989. 63p. Available from NTIS, PC A04/MF A01.

See also PB–89-221451 and PB–89-139117.

This background document provides the Agency's technical support for selecting and developing treatment standards for the only regulated constituent (i.e., chloroform) for the K009 and K010 wastes. Section 2 presents waste-specific information; Section 3 discusses the applicable and demonstrated technologies used to treat the waste; Section 4 summarizes the available performance

data; Section 5 explains EPA's determination of BDAT, while Section 6 discusses the selection of the regulated constituent and deletion of some K009 and K010 constituents originally selected in the proposed rule. Finally, Section 7 presents the determination of the treatment standards.

2769 (PB–89-221477/XAB) **Best demonstrated available technology (BDAT) background document for K011, K013, and K014. Final report.** April, R.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). Jun 1989. 104p. Available from NTIS, PC A06/MF A01.

See also PB–89-139646 and PB–89-221469.

This background document presents the Agency's technical support for selecting and developing the treatment standards for the constituents to be regulated in the acrylonitrile nonwaste waters. The document also contains some information relevant to the acrylonitrile wastewaters. THE EPA will summarize any additional information used to develop performance standards for the waste waters from acrylonitrile production in an addendum to the background document. Because of facility claims of confidentiality, the document does not contain all of the data that EPA used in its regulatory decision-making process.

2770 (PB–89-221485/XAB) **Best demonstrated available technology (BDAT) background document for cyanide wastes.** April, R.; Chatmon-McEaddy, M. Versar, Inc., Springfield, VA (USA). Jun 1989. 311p. Available from NTIS, PC A14/MF A01.

See also PB–89-142228 and PB–89-21477.

This background document provides the Agency's technical support for selecting and developing proposed treatment standards for the constituents to be regulated for the electroplating and metal heat-treating wastes. Sections 2 through 7 present information for the F-code wastes. Section B discusses associated inorganic cyanide P-code wastes and details the development of the proposed treatment standards for these wastes.

2771 (PB–89-221493/XAB) **Best demonstrated available technology (BDAT) background document for K043. Final report.** April, R.; Vorbach, J. Versar, Inc., Springfield, VA (USA). Jun 1989. 47p. Available from NTIS, PC A03/MF A01.

See also PB–89-221485 and PB–89-142236.

The background document provides the Agency's technical support for selecting and developing the proposed treatment standards for the constituents to be regulated in K043 waste. Section 2 presents waste-specific information Section 3 discusses the technologies used to treat the waste; Section 4 presents available performance data; Section 5 explains EPA's detention of BDAT; while Section 6 discusses the selection of constituents to be regulated; and the treatment standards are determined in Section 7.

2772 (PB–89-221501/XAB) **Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report.** Berlow, J.R.; Vorbach, J. Radian Corp., Research Triangle Park, NC (USA). May 1989. 30p. Available from NTIS, PC A03/MF A01.

This background document provides the Agency's rationale and technical support for selecting the constituents to be regulated as F024 wastes and for developing treatment standards for these constituents. The document also provides waste characterization data that serve as a basis for determining whether a variance from a treatment standard may be warranted for a particular type of F024 that is more difficult to treat than the wastes that were analyzed in developing treatment standards for F024.

2773 (PB–89-221519/XAB) **Best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report.** Berlow, J.R.; Jones, L. Radian Corp., Research Triangle Park, NC (USA). 25 May 1989. 96p. Available from NTIS, PC A05/MF A01.

See also PB–89-221501.

This background document provides the Agency's rationale and technical support for selecting the constituents regulated in K028, K029, K095, and K096 nonwaste waters and K028 waste waters and for developing treatment standards for these constituents. The document also provides waste-characterization data that serve as a basis for determining whether a variance from treatment standards may be warranted for a particular type of K028, K029, K095, or K096 waste that is more difficult to treat than the wastes that were analyzed in developing the treatment standards for K028, K029, K095, and K096 nonwaste waters and K028 waste waters.

2774 (PB–89-221527/XAB) **Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report.** Labiosa, J.E. Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. May 1989. 106p. (EPA–530/SW-89/048O). Available from NTIS, PC A06/MF A01.

See also PB–89-142285 and PB–89-221519.

This background document provides the Agency's treatment standards for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K113-4116, U221, and U223). The Agency is not proposing treatment standards for the newly listed wastes K111 and K112 at this time. The document presents waste-specific information, the number and locations of facilities affected by the land-disposal restrictions for K027, K113-K116, U221 and U223 wastes, the waste-generating process, characterization data, and the technologies used to treat the waste or similar wastes. The document also explains the determination of BDAT, selection of constituents to be regulated, and calculation of treatment standards.

2775 (PB–89-223903/XAB) **Analytical methods necessary to implement risk-based criteria for chemicals in municipal sludge.** Bruins, R.J.F.; Fradkin, L.; Stara, J.F.; Peirano, W.B.; Molak, V. Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment. 1989. 11p. (EPA–600/D-89/031). Available from NTIS, PC A03/MF A01.

Pub. in Chemical and Biological Characterization of Sludges, Sediments, Dredge Spoils and Drilling Muds, ASTM STP 976, 465-471 (1988).

The Ambient Water Quality Criteria that were promulgated by the U.S. Environmental Protection Agency in 1980 included water concentration levels which, for many pollutants, were so low as to be unmeasurable by standard analytical methods. Criteria for controlling toxics in municipal sludge would likely pose similar problems of sampling and analysis. Risk-assessment methodologies recently developed by the U.S. EPA provide criteria derivation procedures for each of the following sludge management practices: land application (including distribution and marketing), landfilling, incineration, and ocean disposal. These methodologies recommend that numerical limits on toxicant concentrations in sludge, or on rates of toxicant disposal, should be used to minimize risk to human health and the environment. Implementation of these numerical criteria would require refinement of sampling and analytical techniques for sludges, and various types of field validation studies would be needed to ensure that the criteria are appropriately protective.

2776 (PB–89-224067/XAB) **Turning off the tap: Strategies for hazardous waste minimization in the city of Los Angeles.** Cal-Tech Management Associates, Sacramento, CA (USA). Apr 1987. 143p. Available from NTIS, PC A07/MF A01.

This document is a report on strategies for hazardous-waste minimization for the city of Los Angeles. The report recommends twenty-two actions for the city within a waste-minimization program. The document examines the following topics: Waste Reduction in a Regulatory Context; Hazardous Materials and Waste Management in Los Angeles City and County; Types of Source reduction and local case studies; the elements of a local government waste-reduction program: information and technical assistance; incentives and disincentives for waste reduction; financing waste reduction in the public and private sectors. The document concludes with a 24-page bibliography.

2777 (PB–89-232607/XAB) **Residential cogeneration system development. Annual interim report, February 1988–January 1989.** Drewry, H.S. Kohler Corp., WI (USA). Apr 1989. 30p. Available from NTIS, PC A03/MF A01.

A residential cogeneration system in the range of 4 to 5 kW was developed. The system design effort was placed on developing a

cogeneration system that not only provides heat and electrical power to the home, but also could operate independently of the electrical grid and provide standby or emergency power. Another consideration in the design approach to residential cogeneration was the belief that the small amount of power that could be sold back to the utility could not justify the expense/complex switchgear required. Hence, the approach was to switch individual circuits from the cogeneration system to the utility as required to maximize the cogeneration system load.

2778 (PB–89-871297/XAB) **Incineration studies. October 1985-September 1989 (Citations from the COMPENDEX data base). Report for October 1985-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 106p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868864.

This bibliography contains citations concerning incineration of municipal, industrial, agricultural, and shipboard wastes. Topics include incinerator design, air pollution control, materials and heat recovery, pyrolysis incineration, and economic evaluations. Some attention is given to waste-to-energy operations. (This updated bibliography contains 217 citations, 17 of which are new entries to the previous edition.)

2779 (SVF–340) **Quality control and requirements for corona heated HDPE casing for district heating pipelines.** Janson, L.E. Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden). May 1989. 101p. (In Swedish). Order Number DE90719410. Available from NTIS (US Sales Only), PC A06.

In the present investigation comparative studies have been performed of casing pipes which have been subjected to various degrees of corona treatment. The aim of the study was to try to work out such requirements and testing methods, which would contribute to preventing harmless corona treatment to be applied. The result of the investigation is a recommendation to introduce a standard testing method to expose harmful corona treated pipes. Thus it is proposed a measuring of the absorption spectra at wave length corresponding to 1,710-1,740 cm^{-1} when a thin layer of the pipe material taken from the inner wall surface is irradiated by infrared (IR) light. The thickness of the sample should be standardized to 0.05 mm (+- 0.02 mm). The absorption shall be put in relation to the exact thickness of the sample expressed in mm. The test result shall consequently be given as absorption per 1 mm. This value is recommended not to exceed 0.2 (abs. mm^{-1}). The testing has to be performed as type testing of a corona treatment procedure as well as for continuous manufacturing control. The testing method should also be used as a part of a regular pipe delivery control. It is further recommended that casing pipes meant to be corona treated have to be manufactured by using only original polyethylene grade without any mixture of reworked material.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

2780 (N–89-27700) **Antiproton powered propulsion with magnetically confined plasma engines.** Lapointe, M.R. Sverdrup Technology, Inc., Cleveland, OH (USA). Aug 1989. 26p. (NASA-CR–185131;E–5025;NAS–1.26:185131;AIAA–89-2334;CONF-8907118–: 25. American Society of Mechanical Engineers joint propulsion conference, Monterey, CA (USA), 10-13 Jul 1989). Available from NTIS, PC A03/MF A01.

Matter-antimatter annihilation releases more energy per unit mass than any other method of energy production, making it an attractive energy source for spacecraft propulsion. In the magnetically confined plasma engine, antiproton beams are injected axially into a pulsed magnetic mirror system, where they annihilate with an initially neutral hydrogen gas. The resulting charged annihilation products transfer energy to the hydrogen propellant, which is then exhausted through one end of the pulsed mirror system to provide thrust. The calculated energy transfer efficiencies for a low number density (10(14)/cu cm) hydrogen propellant are insufficient to warrant operating the engine in this mode. Efficiencies are improved using moderate propellant number densities (10(16)/cu cm), but the energy transferred to the plasma in a realistic magnetic mirror system is generally limited to less than 2 percent of the initial proton-antiproton annihilation energy. The energy transfer efficiencies are highest for high number density (10(18)/cu cm) propellants, but plasma temperatures are reduced by excessive radiation losses. Low to moderate thrust over a wide range of specific impulse can be generated with moderate propellant number densities, while higher thrust but lower specific impulse may be generated using high propellant number densities. Significant mass will be required to shield the superconducting magnet coils from the high energy gamma radiation emitted by neutral pion decay. The mass of such a radiation shield may dominate the total engine mass, and could severely diminish the performance of antiproton powered engines which utilize magnetic confinement. The problem is compounded in the antiproton powered plasma engine, where lower energy plasma bremsstrahlung radiation may cause shield surface ablation and degradation.

3301 Internal Combustion Engines

Refer also to citation(s) 2122, 2399, 2400, 2675, 2798, 2799, 2800

2781 (AD-A–210381/0/XAB) **Compatibility of fuel-system components with high density fuel. Final report, April 1987-January 1989.** Grenich, A.F.; Johnson, A.M. Boeing Advanced Systems Co., Seattle, WA (USA). May 1989. 179p. Available from NTIS, PC A09/MF A01.

Environmental and endurance tests were conducted to evaluate the performance of typical fuel-system components when exposed to high-density aviation turbine engine fuel. The environment tests simulated the extreme high and low temperatures encountered in hot- and cold-day missions. The results revealed that the high-density fuel (HDF) would not have any fuel boiling or freezing problems but the pump power required for HDF was higher than for JP-4 fuel as was expected and the lower heat capacity of HDF resulted in noticeably higher heat-exchanger discharge temperatures. The endurance tests revealed that the HDF would not cause abnormal wear or component leakage. Nothing in the test results suggested that current inputs to fuel-system life-cycle-cost models should be modified if HDF is used.

2782 (AD-A–210393/5/XAB) **Ceramics for transportation engines - siren or solution.** Myers, P.S. Wisconsin Univ., Madison, WI (USA). Mar 1989. 19p. Available from NTIS, PC A03/MF A01.

Pub. in Applied Mechanics Reviews, Vol. 42, No. 3, 53-69(Mar 1989).

This paper first reviews the challenges facing transportation engines, particularly cyclic-combustion engines (CCE), which, in numbers, bear the major burden of providing both personal and commercial transportation for mankind. While challenges are not new to CCE, it is imperative that answers be found to these challenges both for the welfare of society and for the survival of CCE. As background for understanding possible answers to these challenges and the part that new materials will play in meeting these challenges, this paper will try to summarize our new and increased understanding of the basic structure of matter. This understanding is essential to comprehending the relationship between atomic and molecular structure, microscopic structure, material processing, and the properties of the resulting materials. The paper will then try to summarize the state of knowledge concerning the use of an old but new material, ceramics, in meeting the challenges faced by cyclic-combustion engines.

2783 (DOE/NASA–0352-3) **Sliding seal materials for low heat rejection engines.** Beaty, K.; Lankford, J.; Vinyard, S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Southwest Research Inst., San Antonio, TX (USA). Jul 1989. 135p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AI01-86CE50162. (NASA-CR–182262;SWRI–06-7963). Order Number DE90002640. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Sliding friction coefficients and wear rates of promising piston seal materials were measured under temperature, environmental, velocity, and loading conditions that are representative of the low heat

rejection (LHR) diesel engine environment. These materials included carbides, oxides, and nitrides. In addition, silicon nitride and partially stabilized zirconia disks (cylinder liners) were ion-implanted with TiNi, Ni, Co, and Cr, and subsequently run against carbide pins (piston rings), with the objective of producing reduced friction via solid lubrication at elevated temperature. Friction and wear measurements were obtained using pin-on-disk laboratory experiments and unique engine friction test rig. Unmodified ceramic sliding coupled were characterized at all temperatures by friction coefficients of 0.24 and above during the pin-on-disk tests. The coefficient at 800°C in an oxidizing environment was reduced to below 0.1, for certain material combination, by the ion-implantation of TiNi or Co. This beneficial effect was found to derive from the lubricious Ti, Ni and Co oxides. Similar results were demonstrated on the engine friction test rig at lower temperatures. The structural integrity and feasibility of engine application with the most promising material combination were demonstrated during a 30-hour single-cylinder, direct-injection diesel engine test. 44 refs., 87 figs., 5 tabs.

2784 (DOE-tr–89-40) **The solitude of a determined inventor.** (La solitude de l'inventeur de fond: L'Unite No. 366). de Gravelaine, F. USDOE, Washington, DC (USA). [1989]. 7p. Translation of. Sponsored by U.S. DOE Management & Administration. Order Number DE90002748. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report discusses an inventor and his invention. The invention is said to make gasoline engines more efficient and nearly pollution free. (JEF)

2785 (ETDE-mf–0717917) **Methanol fuel M 100. Study into boundary conditions and optimisation of constituents.** Lange, W. Deutsche Shell A.G., Hamburg (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Mar 1988. 98p. (In German). BMFT TV 8373. Order Number DE90717917. Available from NTIS (US Sales Only), PC A05/MF A01.

In the present report problems and attempts at solutions are described which were gained above all on the basis of findings in the practice of driving as well as by systematic investigations with test bench engines and laboratory methods. In the operation with methanol (M 100) as fuel the problems are the corrosion effects, the optimization of the starting and running up behaviour in Otto engines, increase in the ignition performance of diesel engines and improvement of the lubricity. (EF).

2786 (PB–89-213821/XAB) **Development of mechanical-pilot injection device for automotive diesel engines.** Sato, T.; Kawagoe, M.; Yamada, M.; Fujimura, T. Toyota Motor Co. Ltd., Aichi (Japan). 1988. 8p. Available from NTIS, PC EE07.

Text in Japanese; Included in Toyota Engineering, Vol. 38, No. 2, 9-16(1988).

With the objective of developing a practicable pilot injection device, simulations were conducted of various simple mechanisms to determine the best specifications and analyze the fuel-injection characteristics. Based on the results, an accumulating type pilot-injection device, which enables the injection-pump pressure-chamber volume to be increased at a given moment during the fuel-compression stroke, was developed and found to remarkably decrease the knock noise during cold idling. An investigation into the effects of the device on output power, exhaust emissions, cold startability, and durability revealed that it is eminently suitable for practical application.

2787 (PB–89-229355/XAB) **Fuel-injected system for diesel engines with injection pressure control.** Nagase, K.; Funatsu, K. Railway Technical Research Inst., Kokubunji, Tokyo (Japan). 1987. 8p. Available from NTIS(Order as PB89-229348 PC$30.00).

Included in Quarterly Reports of Railway Technical Research Institute, Vol. 29, No. 1, 41-47(Feb 1988).

To ensure the efficiency of diesel engines and to eliminate environmental pollution exhaust gas, it is desirable to control the fuel-injection system. The authors proposed a new concept of the fuel-injection control system that would theoretically make it possible to optimize the injection period and quantity of fuel freely in any operation mode of engine by adjusting the injection pressure. They applied this system to a pre-combustion chamber type engine and determined the optimum fuel-injection pressure. Further, by means of an optical fiber probe, they investigated the influence of the injection pressure upon the behavior of combustion.

2788 **Predictability of emissions from in-use vehicles at low-ambient temperature and alternate driving cycle based on standard tests.** Gurney, M.D.; Allsup, J.R. 9p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890625.

Exhaust emission data were generated from a fleet of 24 late model fuel-injected vehicles at ambient temperatures of 75°, 50°, and 20°F using a commercial gasoline with Reid vapor pressure (RVP) of 11.8 psi. Tests were conducted using the standard FTP and a low-speed cold- and hot-start test cycle. The in-use vehicles were tested in an as-received condition without engine adjustment or modification. This paper provides an analysis of the generated data.

2789 **Measurements of the three components of the velocity in the intake ports of an I.C. engine.** Bardsley, M.E.A.; Gajdeczko, B.; Boulouchos, K.; Cherhroudi, B.; Bracco, F.V. 18p. Society of Automotive Engineers, Warrendale, PA (1989). (CONF-890240–: Society of Automotive Engineers international congress and exposition, Detroit, MI (USA), 27 Feb - 3 mar 1989).

Technical Paper 890792.

The three components of the velocity were measured by laser Doppler velocimetry at 35 locations in each of the six intake ports of a single-cylinder I.C. engine motored at 600, 900, and 1200 rpm. The intake ports were designed to impart both swirl and roll to the air. Pressure was also measured at the intake and exhaust. The detailed information is valuable mostly for computations of engine flows and for the assessment of multidimensional models. However the following trends were observed. The intake velocity is affected by resonant pressure waves. The flows in the six ports tend to be similar. The three components of the ensemble- averaged velocity generally have uniform profiles across the port area, whereas the fluctuation intensities are higher at the top of the port. All velocities tend to be higher at the beginning and end of intake. Averaged over the port area and intake time, the ensemble- averaged radial and axial velocity components are about 5 times the mean piston speed, the tangential component is about 10 times, and the fluctuation intensities are between 2 and 3.4 times.

3302 External Combustion Engines

Refer also to citation(s) 2906

3303 Electric-powered Systems

Refer also to citation(s) 2576, 2577, 2582, 2583, 2584, 2585, 2586, 2587, 2588

2790 (DOE/ID–10219) **National program plan for electric vehicle battery research and development: Technical plan.** Henriksen, G.L.; Douglas, D.L.; Warde, C.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1989. 70p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE90002023. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

EVs offer the prospect of reducing US petroleum fuel usage and air pollution in major metropolitan areas. In 1987, DOE-EHP commissioned a two-phase study at INEL to produce a national plan for R&D on battery technology – the limiting component in EVs. The battery assessment phase identified the "most-promising" technologies from a comprehensive list of viable EV batteries. This multi-year R&D program plan identifies development schedules, milestones, and tasks directed at resolving the critical technical and economic issues for the most-promising developmental batteries: bipolar lead/acid, flow-through lead/acid, iron/air, lithium/iron sulfide, nickel/iron, sodium/metal chloride, sodium/sulfur, zinc/air, and zinc/bromine. 8 refs., 1 fig., 6 tabs.

2791 (DOE/ID–10252) **Electric and hybrid vehicles: Technical background report for the DOE flexible and alternative fuels**

study. Hamilton, W. EG and G Idaho, Inc., Idaho Falls, ID (USA). 21 Jul 1989. 165p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE90002218. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report was prepared to provide background information on electric and hybrid vehicles (EHVs) for a Department of Energy assessment of the costs and benefits of flexible and alternative fuel use in the US transportation sector. As required by the assessment, this report focuses on the potential characteristics and impacts of large-scale EHV production and use, rather than on the policies, decisions, activities and events which might be required to assure the introduction of EHVs into US transportation on such a scale. This report is primarily a composite of existing papers and reports on EHVs. It offers new calculations only where necessary to assemble a consistent and reasonably complete picture. Its emphasis is on results and conclusions rather than analytic methods or available data. It is intentionally brief: in comparison, the EHV test reports and technical papers from which it draws would fill a bookshelf. 14 refs., 18 figs., 55 tabs.

2792 (EGG-M–89258) **Characterization of electric vehicle velocity and power profiles using road test data.** Burke, A.F.; Fink, R.K.; Richardson, R.A.; Dowgiallo, E.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-8908144–3: SAE conference and expo on future transportation technology, Vancouver (Canada), 6-10 Aug 1989). Order Number DE90002085. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The use of electric vehicle road test data to characterize various missions in terms of velocity time-histories and battery power profiles is discussed. The data utilized were taken on the Griffon Van at Detroit Edison using the VDAS on-board data system, which stores the data in several frequency-of-occurrence matrices. Time-based data are not available from VDAS. Construction of velocity-time cycles from the mechanical power-velocity matrices has proven to be difficult. A new VDAS, which stores the vehicle/battery data in time-based files, has been designed and built at the INEL. Bench testing of the unit is near completion and in-vehicle testing should begin in June 1989. The new VDAS utilizes the same sensors as in the original VDAS and will yield essentially the same data variables. The frequency-of-occurrence matrices can be constructed from the time-based data using a Vax 2000 workstation and commercially available software. Work is continuing on developing vehicle and battery test cycles from VDAS field data for the various missions. The availability of vehicle and battery data taken with an on-board data system permits the characterization of a variety of missions for different vehicle powertrains and batteries. Vehicle and battery designers will then have the information needed to assess the suitability of particular vehicle and battery designs for particular missions and applications. 6 refs., 8 figs., 4 tabs.

2793 (EGG-M–89361) **Battery technology assessment and R and D plan.** Henriksen, G.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 11p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-8909181–6: Electric and hybrid vehicle contractors' meeting, Idaho Falls, ID (USA), 6-8 Sep 1989). Order Number DE90002007. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

To guide future EV battery R and D programs, the US Department of Energy (DOE) commissioned a comprehensive assessment of secondary battery technologies. A total of 67 battery developers – from the United States, Canada, Europe, Asia, and Africa – were solicited to submit battery design concepts for an "Improved Dual-Shaft Electric Propulsion" (IDSEP) van. A team of 10 consultants and 7 representatives from DOE laboratories evaluated 42 developer responses and consultant-prepared designs. Using six criteria – five technical/economic criteria and a maturity/technical barriers criterion – the assessment identified 12 most-promising batteries. Employing a generic EV-battery development-process framework, the assessment results were used to formulate multi-year R and D plans and schedules for the most-promising developmental batteries. 7 refs., 3 figs., 4 tabs.

3304 Hybrid Systems

Refer also to citation(s) 2577, 2790, 2791, 2792

2794 (ANL–89/28) **An assessment and comparison of fuel cells for transportation applications.** Krumpelt, M.; Christianson, C.C. Argonne National Lab., IL (USA). Sep 1989. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. Order Number DE90001807. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fuel cells offer the potential of a clean, efficient power source for buses, cars, and other transportation applications. When the fuel cell is run on methanol, refueling would be as rapid as with gasoline-powered internal combustion engines, providing a virtually unlimited range while still maintaining the smooth and quiet acceleration that is typical for electric vehicles. The advantages and disadvantages of five types of fuel cells are reviewed and analyzed for a transportation application: alkaline, phosphoric acid, proton exchange membrane, molten carbonate, and solid oxide. The status of each technology is discussed, system designs are reviewed, and preliminary comparisons of power densities, start-up times, and dynamic response capabilities are made. To test the concept, a fuel cell/battery powered urban bus appears to be a good first step that can be realized today with phosphoric acid cells. In the longer term, the proton exchange membrane and solid oxide fuel cells appear to be superior. 13 refs., 5 figs., 2 tabs.

3305 Flywheel Propulsion

Refer also to citation(s) 2562

3307 Emission Control

Refer also to citation(s) 2080, 2788, 2801

2795 (PB–89-213839/XAB) **Development of thermal-resistant catalysts.** Matsumoto, S.; Miyoshi, N.; Kimura, M.; Ozawa, M. Toyota Motor Co. Ltd., Aichi (Japan). 1988. 10p. Available from NTIS, PC EE07.

Text in Japanese; Included in Toyota Engineering, Vol. 38, No. 2, 17-26(1988).

Thermal deactivation is one of the most critical factors against the durability of 3-way catalysts. First the phenomenon of the thermal deactivation was studied. The main cause of the deactivation of 3-way catalysts was the sintering of alumina support, accompanied by coalescence of noble metal particles. Next, effects of additives were studied. To stabilize the alumina support, the addition of the optimal amount of lanthanum was very effective. Moreover, lanthanum improves not only the alumina stability but also the catalytic activity. It found that lanthanum would interact with Rh to change the condition of NO adsorbed, and form the complex oxide with ceria which would enhance the activity of ceria. On the basis of the findings, optimal 3-way catalysts which have shown a significantly improved thermal durability and performance have been designed.

2796 (PB–89-220925/XAB) **Measurement of on-road vehicle emission factors in the California South Coast Air Basin. Volume 1. Regulated emissions. Final report.** Ingalls, M.N.; Smith, L.R.; Kirksey, R.E. Southwest Research Inst., San Antonio, TX (USA). Jun 1989. 172p. (SWRI–1604). Available from NTIS, PC A08/MF A01.

Portions of this document are not fully legible.

This project sampled running emissions from over 40,000 in-use vehicles in normal traffic operation in a tunnel. Slow-speed emissions, evaporative emissions, and cold-start emissions were sampled from over 340 cars in a parking garage. Sampling was accomplished by measuring the pollutant concentrations in the inlet and exhaust air of these two enclosed spaces. The difference between the inlet and exhaust concentrations was the vehicle contribution to the pollutant concentrations. Airflow as well as vehicle count and speed were determined during each sample period. These variables, when used with the pollutant concentrations, enabled emissions per vehicle to be calculated. Description of the sampling instrumentation and procedures for traffic variables and regulated emissions, as well as the regulated emission results are

presented here. Unregulated emission measurements will be presented in Volume II.

2797 (PB–89-230106/XAB) **Programmer's guide to MOBILE4 (mobile source emission factor model). Technical report.** Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div. Jul 1989. 569p. (EPA/AA/TEB–89/02). Available from NTIS, PC A24/MF A01.

See also PB–89-164271.

This programmer's guide for the MOBILE4 mobile source emission factor model contains a listing of the program source code, a structure chart, a module dictionary, an execution summary, and discussions of porting of the MOBILE4 program to microcomputers and of potential program modifications.

3308 Alternative Fuels

Refer also to citation(s) 2618, 2785

2798 (DOE/MC/22123–2735-Vol.1) **Coal-fueled diesel systems research: Volume 1, Basic fuel, fuel system, and combustion studies: Final report.** General Motors Corp., Indianapolis, IN (USA). Allison Gas Turbine Div.; Southwest Research Inst., San Antonio, TX (USA). Jul 1989. 260p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-85MC22123. Order Number DE89011695. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

The overall objective of this program was to investigate the economic and technical features for a coal-fueled diesel locomotive system. Commercialization merits of coal-fueled locomotives were examined. Bench scale screening tests and full scale verification tests were conducted to determine the effects of selected coal fuels on fuel specification, handling, injection, ignition/combustion, and engine wear. Technology deficits would be noted for recommended future evaluation. 113 refs., 71 figs., 30 tabs.

2799 (DOE/MC/22123–2735-Vol.2) **Coal-fueled diesel systems research: Volume 2, Engine operation, durability and economic: Final report.** General Motors Corp., Indianapolis, IN (USA). Allison Gas Turbine Div.; General Motors Corp., La Grange, IL (USA). Electro-Motive Div.; Adiabatics, Inc., Columbus, IN (USA). Jul 1989. 107p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-85MC22123. Order Number DE89011696. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The overall objective of this program was to investigate the economic and technical features for a coal-fueled diesel locomotive system. Commercialization merits of coal-fueled locomotives were examined. Bench scale screening tests and full scale verification tests were conducted to determine the effects of selected coal fuels on fuel specification, handling, injection, ignition/combustion, and engine wear. Technology deficits would be noted for recommended future evaluation. 22 refs., 81 figs., 14 tabs.

2800 (ETDE-mf–0717888) **Determination of the dependence of engine characteristics on the properties of alternative fuels.** Hesse, A.; Krause, D. Hannover Univ. (Germany, F.R.). Inst. fuer Kolbenmaschinen; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Jun 1986. 145p. (In German). BMFT MTK 0292 5. Order Number DE90717888. Available from NTIS (US Sales Only), PC A07/MF A01.

The object of the overall project are investigations of different fuel mixtures in two diesel engines with regard to ignition and burn-through behaviour, molecular structure of the fuel and its correlation to the ignition behaviour as well as to the wear characteristics of the liner and piston ring of the engines. For this purpose fuels on a basis of mineral oil, methanol and coal oil were used, with provenance and refining, mixture components and preparation conditions in the engine being of great importance. Besides the peak pressure, also the ash content, content of aromatics and acid-forming components of the mixture components have, an influence on the wear behaviour. For the ignition and burn-through characteristics parameters such as the total content of aromatics, ignition temperature, proportions of components with high cetane numbers, the concentration of a certain group of aromatics as well as the fuel density are essential. (RB).

2801 (PB–89-231575/XAB) **Caterpillar 3406 spark-ignited natural-gas-engine emissions on EPA (Environmental Protection Agency) heavy-duty transient test cycle. Topical report, March-December 1988.** Waldman, D.J.; Gladden, J.R.; Endicott, D.L.; Cull, B.A. Caterpillar, Inc., Peoria, IL (USA). Jan 1989. 45p. Available from NTIS, PC A03/MF A01.

The emissions of a lean-burn natural-gas-fueled 3406 spark-ignited engine were determined on the EPA transient emission cycle for heavy-duty vehicle engines. The engine was rated at 350 hp at 1800 rpm. The engine was a minimally modified generator-set engine developed under the same GRI contract and was not optimized for truck applications or transient emissions. Transient emissions in g/hp-hr were 4.1 NOx, 9.2 total hydrocarbons, 0.84 non-methane hydrocarbons, 3.2 CO, 0.42 aldehydes, and 0.60 particulates. Steady-state emissions were also measured. The results indicate lean-burn spark-ignited engine technology is a promising approach to meeting 1994 EPA truck-engine-emission standards. NOx and CO standards can be readily met. Hydrocarbon emissions exceed the standard in the engine as presently configured but are believed to be controllable by improved air/fuel ratio control, combustion-system modification and/or an oxidation catalyst. The particulates were primarily from the lubricating oil and should be controllable with piston ring and valve-seal improvements and/or an oxidation catalyst.

35 ARMS CONTROL

2802 (UCRL–98434) **Concerning advanced architectures for strategic defense.** Wood, L. Lawrence Livermore National Lab., CA (USA). [1988]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8803244–1: Strategic defense initiative: first five years conference, Washington, DC (USA), 13-15 Mar 1988). Order Number DE90001894. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report gives a brief history of strategic defense, then leads to modern architectures in such programs. (JEF)

3501 Policy, Negotiations, and Legislation

2803 (DOE/DP/50066–T1) **United States policy on negative security assurances: A reassessment.** Carnahan, B. Science Applications International Corp., McLean, VA (USA). 17 Oct 1989. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC01-88DP50066. Order Number DE90002551. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

during the negotiation of the Nuclear Non-Proliferation Treaty (NPT), the non-nuclear weapon states maintained that the Treaty should include "negative security assurances," (NSA) to flow to them from the nuclear weapons states, promising that they would not be subject to nuclear attack. Such assurances were not included in the NPT, in part because the United States, United Kingdom and the Soviet Union undertook to deal with this issue in some other form. The issue remains linked to the NPT regime, however, and has been considered at the NPT Review Conferences. This paper covers the current status and upgrade strategies for NSA.

3502 Proliferation

2804 **Can the U.S. economy survive a few nuclear weapons.** Sastry, M.A. (Stanford Univ., CA (USA)); Romm, J.J.; Tsipis, K. *Technology Review (USA)*, 92(3): 22-29 (Apr 1989).

This paper discusses the survivability of the U.S. economy following a small nuclear war-one involving 1-2% of the nuclear arsenals of the U.S. and U.S.S.R. The authors presume that liquid fuel facilities would be the principal target and they use a computer model commissioned by the U.S. Federal Emergency Management Agency (FEMA) to examine the fate of the U.S. economy after such an attack. Using the results of this study, the authors address the viability of the current nuclear arms buildup as well as that of the Strategic Defense Initiative (SDI).

36 MATERIALS

Refer also to citation(s) 2610

2805 Heat transfer. Kim, J.H.; Ro, S.T.; Lee T.S. 552p. Hemisphere Publishing, New York, NY (1988). (CONF-8610118–: Korea/US joint heat transfer seminar on thermal engineering and high technology systems, Seoul (Republic of Korea), 16-22 Oct 1986).

These proceedings contain 13 papers grouped under the headings of: High-temperature materials for power generation; High-temperature materials for aerospace; and Advanced material for ground transportation.

3601 Metals and Alloys

Refer also to citation(s) 2093, 2164, 2307, 2396, 2414, 2432, 2442, 2444, 2445, 2457, 2465, 2513, 2531, 2553, 2572, 2903, 2923, 2969, 3213, 3214, 3220, 3315, 3468, 4203, 4206, 4215, 4404, 4470, 4473, 4478, 4544

2806 (AD-A–210307/5/XAB) **Influence of microstructure and microdamage processes on fracture at high loading rates. Final report, 1 February 1986-30 September 1988.** Giovanola, J.H.; Kloop, R.W.; Simons, J.W.; Kobayashi, T.; Shockey, D.A. SRI International, Menlo Park, CA (USA). 26 Jun 1989. 48p. (TR–90). Available from NTIS, PC A03/MF A01.

The objectives of this three-year program were to establish how microstructure and loading rate influence the fracture behavior of Ti-10V-2Fe-3Al, a promising advanced titanium alloy increasingly used in aircraft structural components, and to relate the macroscopic fracture toughness results to microdeformation and microdamage processes with a view toward developing microstructurally based fracture models. Such models are desirable to develop compositions and processing conditions resulting in optimum mechanical properties.

2807 (AD-A–210658/1/XAB) **Exploratory study of niobium, titanium, zirconium, and tantalum aluminides. Final report, 1 March 1988-31 May 1989.** Stoloff, N.S. Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering. 1 Jul 1989. 24p. Available from NTIS, PC A03/MF A01.

The microstructure, crystal structures of existing phases, hardness, and slip systems for several binary and ternary aluminides were determined. Arc melted samples purchased from an external supplier invariably cracked upon cooling in the arc melting unit, thereby hampering the ability to prepare mechanical-test specimens. Homogenization heat treatments in vacuum usually led to significant porosity, apparently due to loss of aluminum. The properties of arc-melted material are compared to those derived from similar compositions prepared by powder-metallurgical techniques.

2808 (AD-A–211099/7/XAB) **Rhenium alloying of tungsten heavy alloys.** German, R.M.; Bose, A.; Jerman, G. Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering. 1989. 6p. Available from NTIS, PC A02/MF A01.

Pub. in Powder Metallurgy International, Vol. 20, No. 3, 9-13(1989).

Alloying experiments were performed using rhenium additions to a classic 90 mass % tungsten heavy alloy. The mixed-powder system was liquid phase sintered to full density at 1500 C in 60 min The rhenium-modified alloys exhibited a smaller grain size, higher hardness, higher strength, and lower ductility than the unalloyed system. For an alloy with a composition of 84W-6Re-8Ni-2Fe, the sintered density was 17, 4 Mg/m^3 with a yield strength of 815 MPa, tensile strength of 1180 MPa, and elongation to failure of 13%. This property combination results from the aggregate effects of grain size reduction and solid solution hardening due to rhenium. In the unalloyed system these properties require post-sintering swaging and aging; thus, alloying with rhenium is most attractive for applications where net shaping is desired, such as by powder injection molding.

2809 (AD-A–211154/0/XAB) **Growth of tungsten bronze family crystals. Final technical report, 6 May 1985-30 November 1988.** Neurgaonkar, R.R.; Cross, L.E. Rockwell International Corp., Thousand Oaks, CA (USA). Science Center. Mar 1988. 197p. (SC–5441.FTR). Available from NTIS, PC A09/MF A01.

A systematic investigation of tungsten bronze crystals for electro-optic and photorefractive applications was carried out successfully. The $Sr_{1-x}BaXNb_2O_6$ (SBN) and $Ba_{2-x}SrXK_{1-y}NaYNb_5O_{15}$ (BSKNN) system crystals were grown in optical quality with and without specific impurities whose purpose is to enhance photorefractive coupling and speed. Both SBN and BSKNN crystals appear to be excellent hosts for electro-optic applications, e.g., modulators, waveguides, and spatial light modulators (SLM) and photorefractive applications, e.g., phase conjugation, image processing, optical computing and laser hardening. For photorefractive applications, cerium and chromium doping show the largest effects on photorefractive coupling and speed.

2810 (AD-A–211166/4/XAB) **Strain aging in tungsten-heavy alloys. Final report.** Dowding, R.J.; Tauer, K.J. Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab. Jul 1989. 15p. (MTL-TR–89-63). Available from NTIS, PC A03/MF A01.

It has been shown that strengthening of tungsten-heavy alloys is possible through the use of cold working and heat treatment. The source of the increased strength has been attributed to strain aging due to the presence of carbon. Further, it was shown that this increase in strength did not have to be at the expense of elongation. For a 90% tungsten-heavy alloy, the strength increased from 164.7 ksi in the as-swaged condition to 178.4 ksi when heat treated at 700C for 1 hour. Under the same conditions the elongation increased from 10.8% to 12 .2%. Similar results were observed for a 93% tungsten-heavy alloy. The strength increased from 173.9 ksi as-swaged, to 197.0.o ksi when heat treated for 1 hour at 600 C. The elongation fully recovered at 800 C, held for 1 hour.

2811 (BARC–1449) **Evaluated phase diagrams of binary metal-tellurium systems of the D-block transition elements.** Chattopadhyay, G.; Bharadwaj, S.R. Bhabha Atomic Research Centre, Bombay (India). 1989. 118p. Order Number DE90607963. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The binary phase diagrams of metal-tellurium systems for twenty seven d-block transition elements have been critically evaluated. Complete phase diagrams are presented for the elements, chromium, manganese, iron, cobalt, nickel, copper, molybdenum, palladium, silver, lanthanum, platinum and gold, whereas, for scandium, titanium, vanadium, yttrium, zirconium, niobium, technitium, ruthenium, rhodium, hafnium, tantalum, tungsten , rhenium, osmium and iridium, the phase diagrams are incomplete and tentative. (author). 20 refs., 27 tabs., 27 figs.

2812 (BNL–43108) **Magnetic viscosity in Ni/Cu compositionally-modulated alloys.** Bennett, L.H.; Swartzendruber, L.J.; Ettedgui, H.; Atzmony, U.; Lashmore, D.S; Watson, R.E. Brookhaven National Lab., Upton, NY (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891117–6: 34. conference on magnetism and magnetic materials, Boston, MA (USA), 28 Nov - 1 dec 1989). Order Number DE90002303. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The existence of a magnetic aftereffect ("magnetic viscosity") in Ni/Cu multilayered alloys was established using a vibrating sample magnetometer at room temperature and at 86 K. It was shown that the effect is strongly dependent on the step field, H_2 (i.e., the value the field is reduced to after the magnetic moment has been aligned in high field) and exhibits a maximum relaxation rate for values of H_2 around the reverse coercive field, $-H_c$. Aftereffect behavior of this type has been observed in other materials, though most often for systems composed of superparamagnetic particles, where the relaxation freezes out at low temperatures. In contrast, the relaxation in the CMA was shown to be enhanced at 86 K over its value at room temperature. New measurements over a wider temperature range show that the enhancement in this sample reaches a maximum near 120 K, but below that temperature the relaxation does freeze out. The temperature of maximum enhancement varies from sample to sample. 6 refs.

2813 (CEA-CONF–9877) **Stress corrosion cracking of nickel base alloys characterization and prediction.** Santarini, G.;

Pinard-Legry, G. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Chimie Appliquee et d'Etudes Analytiques. 1988. 9p. (CONF-8810443--: EUROCORR'88: Symposium on Corrosion, Brighton (UK), 3-5 Oct 1988). Order Number DE90721179. Available from NTIS (US Sales Only), PC A02/MF A01.

For many years, studies have been carried out in several laboratories to characterize the IGSCC (Intergranular Stress Corrosion Cracking) behaviour of nickel base alloys in aqueous environments. For their relative shortness, CERTs (Constant Extension Rate Tests) have been extensively used, especially at the Corrosion Department of the CEA. However, up to recently, the results obtained with this method remained qualitative. This paper presents a first approach to a quantitative interpretation of CERT results. The basic datum used is the crack trace depth distribution determined on a specimen section at the end of a CERT. It is shown that this information can be used for the calculation of initiation and growth parameters which quantitatively characterize IGSCC phenomenon. Moreover, the rationale proposed should lead to the determination of intrinsic cracking parameters, and so, to in-service behaviour prediction.

2814 (CEA-R-5475) **Stress corrosion cracking of an uranium-6 weight per cent niobium in gaseous oxygen, nitrogen and hydrogen.** Brunet, H. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1989. 323p. (In French). Order Number DE90721226. Available from NTIS (US Sales Only), PC A14/MF A01.

Stress corrosion cracking (SCC) of uranium-6 weight per cent niobium alloy is studied in gaseous oxygen at room temperature (for pressures between 4.10^{-7} and 0.15MPa) and 100°C (pressure of 0.15 MPa) and in gaseous hydrogen (for pressures between 10^{-6} and 0.15 MPa). SCC map and cracking kinetics are determined as fonctions of stress-intensity factor, pressure and temperature. For oxygen, temperature seems to have no effect on the alloy embrittlement within the range of this study but the pressure influence is more complex. At room temperature, hydrogen pressure less than 0.15 MPa has no influence on the cracking kinetics. For a pressure of 0.15 MPa, fracture occurs by hydriding reaction. Complementary analyses on fracture surfaces lead to propose different mechanics responsible for cracking kinetics in these environments.

2815 (CEGB-RD/B-6040/R88) **Role of $Fe_xCr_{2-x}O_3$ standard solid solutions in the identification of rhombohedral phase composition by XRD.** Jutson, J.A.; Tempest, P.A. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Nov 1988. 16p. Order Number DE90607993. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The oxide layer formed on AGR reactor steels in a CO_2/CO coolant environment contains two major components, a cubic spinel phase and a rhombohedral phase. In general the rhombohedral phase protects the underlying steel from further attack better than the spinel phase. The rhombohedral phase may be Cr_2O_3 or a solid solution of αFe_2O_3 and Cr_2O_3. The composition of the solid solution can be identified using X-ray diffraction techniques (XRD). Standard solid solutions of the rhombohedral phase have been prepared and characterised by XRD. The generation of calibration curves relating lattice parameter or d-spacing to oxide composition enables the composition of the rhombohedral phase formed on samples of reactor steels to be identified. (author).

2816 (CEGB-RD/L-3354/R88) **Ageing kinetics of CF3 cast stainless steel in the temperature range 300°C to 400°C.** Akhurst, K.N.; Pumphrey, P.H. Central Electricity Research Labs., Leatherhead (UK). Nov 1988. 23p. Order Number DE90607968. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The primary coolant pump casings for Sizewell 'B' are made from castings of ASME SA351 CF3 steel which, although predominantly austenitic, is required to contain a small proportion of ferrite. Previous studies have shown that such steels are susceptible to hardening of the ferrite, and associated losses in toughness, as a result of thermal ageing for long times at the service temperature (~ 300°C). For this reason, toughness tests are to be carried out on representative castings made by the Sizewell 'B' pump casing manufacturer. The purpose of these tests is to demonstrate adequate end-of-life fracture resistance, using material which has been given an accelerated ageing treatment. The identification and validation of a suitable ageing treatment is the subject of this Report. Ageing kinetics have been measured for ageing temperatures in the range 300 to 400°C, from the results of Charpy impact tests on material from the castings procured for the main fracture programme. Castings with ferrite levels of 15, 25 and 35% have been studied. The losses in impact toughness have been related to the kinetics of ferrite strengthening using microhardness measurements, and to microstructural changes using Field Ion Atom Probe analysis. (author).

2817 (CEGB-TPRD/M-1697/RR88) **Weld simulated US Mod 9Cr 1 Mo steel: Pt. 1. General microstructure.** Ferranti, M. Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs. Apr 1988. 29p. Order Number DE90607959. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A microstructural investigation of simulated welds in US Mod 9Cr1Mo ferritic steel has been undertaken using transmission electron microscopy, with EDX microanalysis and hardness transverse measurements. Samples have also been normalised at 1040°C for 0.5h and tempered at 760°C for 1h under conditions which have been reported elsewhere as leading to the best creep properties. Observations include both base metal and heat affected zones in the welded and postwelded heat treated conditions. Particular emphasis was given to the interface of the above regions, where a hardness drop related to a degradation of creep properties had been detected by a number of studies. The results include the identification of precipitates, their chemical composition and a description of the various morphologies observed. The main findings are discussed in terms of the thermal cycle associated with the weld simulation and the presence of strong carbide formers such as vanadium and niobium. (author).

2818 (CONF-891093--11) **Chemical cleaning of aluminum alloy surfaces for use as vacuum materials in synchrotron light sources.** Kaufherr, N.; Krauss, A.; Gruen, D.M.; Nielsen, R. Argonne National Lab., IL (USA). [1989]. 19p. Sponsored by U.S. DOE Energy Research. From 36. American Vacuum Society national vacuum symposium; Boston, MA (USA); 23-27 Oct 1989. Order Number DE90002859. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Photon and electron desorption from the vacuum chamber walls of electron storage rings such as the proposed Advanced Photon Source (APS), are sometimes responsible for the production of large gas loads during operation even in systems with very good static vacuum. The gas released by beam-induced desorption results in scattering of the beam electrons, and a consequent reduction in the beam lifetime. In extreme cases, the beam-induced outgassing may cause so much scattering that it is not possible to obtain the design goals with regard to obtainable beam current. Consequently, it is important that the surfaces which are exposed to the electron beam and photon fluxes contain as little trapped gas as possible, and that the gas burden during operation be kept as low as possible. The current study investigates the effectiveness of a chemical cleaning treatment developed at CERN for the LEP storage ring, as applied to the 6063 alloy to be used in APS. Additionally, depth profiling of the chemically cleaned samples and samples which were vapor-degreased only, provides new insight on the cleaning process as it applies to the alloy proposed for use in APS. 14 refs., 8 figs., 1 tab.

2819 (CONF-891117--8) **Spin dynamics of amorphous $Fe_{90-x}Ni_xZr_{10}$.** Fernandez-Baca, J.A.; Rhyne, J.J.; Fish, G.E.; Hennion, M.; Hennion, B. Oak Ridge National Lab., TN (USA). [1989]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 34. conference on magnetism and magnetic materials; Boston, MA (USA); 28 Nov - 1 dec 1989. Order Number DE90002474. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Amorphous $Fe_{90-x}Ni_xZr_{10}$ is a system that exhibits a relatively high degree of magnetic exchange frustration, which becomes stronger as the system approaches the composition of amorphous pure iron. Thus, while samples with moderate amounts of iron ($x \geq 5$) are ferromagnetic, the samples with the highest concentration of iron ($x \leq 1$) behave like reentrant spin glasses. We have performed a detailed neutron scattering study of the spin-wave excitations in this system for x = 1, 5, 10, 20. In all cases well defined spin-wave excitations were observed below a transition temperature T_c that

decreased from 455 K (for x = 20) to 250 K (for x = 1). For x = 5, 10, 20 the spin-wave stiffness coefficient follows the temperature dependence expected for a conventional ferromagnet but the spin-wave excitations broaden considerably at low temperatures. For x = 1 the spin-wave stiffness coefficient softens at low temperatures and an elastic component of the scattering, associated with development of a spin glass order parameter, appears below $T \approx 0.28T_c$. A coexistence of propagating spin-wave excitations and spin freezing phenomena is observed below this temperature down to $T = 0.09T_c$. These results are discussed in terms of the relevant current theories. 30 refs., 5 figs., 1 tab.

2820 (CONF-8707219–1) **Engineering approaches to the application of fracture toughness data in the nuclear industry.** Merkle, J.G. Oak Ridge National Lab., TN (USA). [1989]. 11p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From Materials Properties Council workshop on scatter of fracture toughness data in the transition temperature regime; Boulder, CO (USA); 16 Jul 1987. Order Number DE90001596. Available from NTIS, PC A03/MF A01; OSTI; INIS.

The procedures for measuring the plane strain fracture toughness, K_{Ic}, of metals were originally developed for relatively high yield strength materials, the toughnesses of which were not affected by strain rate. The application of these procedures to lower yield strength and higher toughness structural and pressure vessel steels have since revealed a perplexing combination of problems involving the effects of geometry, stable crack growth and strain rate on the measured values of toughness. Only the geometric problems were encountered in the development of the procedures for measuring K_{Ic}. For fracture in the linear elastic range of the load-displacement curve, these problems were overcome by specifying specimen dimensions sufficiently large with respect to the plastic zone size at fracture. However, in the case of structural and pressure vessel steels, it is not always possible to test specimens large enough for fracture to occur prior to general yielding. Therefore, in these cases, the effects of large-scale yielding prior to fracture cannot be avoided, but since they presently have no analytical explanation they are being treated empirically. The problems of geometry and strain rate effects on toughness discussed herein are complex and difficult to solve. However, taking advantage of the improvements that have recently been made in the hardware and software available for performing three-dimensional elastic-plastic and viscoplastic stress analysis, it should be possible to significantly improve the analysis of small-specimen, elastic-plastic fracture toughness data.

2821 (CONF-8904290–1) **Elastic softening in nanocrystalline silicon.** Philipot, S.R.; Wolf, D.; Lutsko, J.F. Argonne National Lab., IL (USA). May 1989. 7p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium J: interfaces between polymers, metals and ceramics; San Diego, CA (USA); 24-29 Apr 1989. Order Number DE90002268. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

It is pointed out that some of the generic physical properties of a nanocrystalline material are similar to those of a grain-boundary superlattice. The structure and elastic properties of a superlattice of twist boundaries on the (110) plane of silicon are calculated as a function of modulation wavelength using a three-body potential. All elastic moduli are found to be softened. This softening is attributed to the relatively small amount of structural disorder at the interfaces. 8 refs., 4 figs.

2822 (CONF-8905188–2) **Surface magneto-optical studies of ultrathin ferromagnetic films.** Liu, C.; Bader, S.D. Argonne National Lab., IL (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Conference on magnetic properties of low-dimensional systems II; San Luis Potosi (Mexico); 22-26 May 1989. Order Number DE90002199. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The surface magneto-optic Kerr effect is used to study the existence of monolayer magnetism and the surface magnetic anisotropy of epitaxial films of Fe deposited on Cu(100), Ru(0001), and Pd(100). The critical behavior of Fe/Pd(100) is also characterized and found to be in agreement with 2-D Ising-model results.

2823 (CONF-8905239–1) **Quasicrystals and grain boundaries.** Rivier, N. Argonne National Lab., IL (USA). Jul 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 3. international meeting on quasicrystals: incommensurate structures in condensed matter; Vista Hermosa (Mexico); 29 May - 2 jun 1989. Order Number DE90002213. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recent experimental and theoretical evidence suggests that grain boundaries are quasiperodic structures made of inflatable sequences of structural units. A general grain boundary is a grid of dislocations with the same inflation multiplier (a quadratic irrational) in every direction. Structural units are defined topologically as screw or edge dislocation lines on the boundary. Inflation is a geometrical and arithmetic operation expanding a finite sequence of topological units into a longer one. The structure has inflation symmetry if the same operation is repeated. Whereas inflation generalizes translation symmetry of classical crystallography, a direct product of inflatable sequences forms a tiling which realizes rotation symmetry. The two symmetries are compatible for only a few distinct patterns, up to affinities. Bulk quasicrystalline particles can grown on some grain boundaries, suggesting that quasicrystals are structures of minimal free energy under specific, but not common boundary conditions. 23 refs., 9 figs.

2824 (CONF-8906247–1) **Nanophase materials assembled from atomic clusters.** Siegel, R.W. Argonne National Lab., IL (USA). Sep 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International symposium on physics of new materials; Osaka (Japan); 16 Jun 1989. Order Number DE90002204. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The preparation of atomic clusters of metals and ceramics by means of the gas-condensation method, followed by their in situ consolidation under high-vacuum conditions, has recently led to the synthesis of a new class of ultrafine-grained materials for which their physics is intimately coupled with their application. These nanophase materials, with 2 to 20 nm grain sizes, appear to have properties that are often rather different from conventional materials, and also processing characteristics that are greatly improved. The nanophase synthesis method described here should enable the design of materials heretofore unavailable, with improved or unique properties, based upon an understanding of the physics of these new materials. 23 refs., 8 figs.

2825 (CONF-8908175–1) **Embrittlement of laboratory- and reactor-aged CF-3, CF-8, and CF-8M duplex stainless steels.** Chung, H.M.; Leax, T.R. Argonne National Lab., IL (USA). Oct 1989. 30p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. From International workshop on intermediate-temperature embrittlement processes in duplex stainless steels; Oxford (UK); 1-2 Aug 1989. Order Number DE90002777. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Cast duplex stainless steels of CF-3, CF-8, and CF-8M grades, containing a wide range of chemical composition and ferrite content, were aged in the laboratory at 270 to 450°C to evaluate the kinetics and mechanisms of thermal-aging embrittlement. CF-8 and CF-8A steels were also obtained from components of BWRs and PWRs after service of 12 to 22 yr. After mechanical-property (i.e., Charpy impact, tensile, and J-R curve) and microhardness tests, the aged specimens were examined by transmission electron microscopy and field-ion atom-probe techniques to elucidate the aging mechanisms and identify critical factors that control the embrittlement kinetics. From the results of microstructural characterization, the primary and secondary embrittlement mechanisms were identified. A mechanistic correlation was obtained between the microstructural characteristics and the activation energy of aging (i.e., the temperature dependence of the aging kinetics) for steels with a range of chemical compositions and subjected to different fabrication and thermal-treatment conditions. The unified correlation, based on spinodal decomposition influenced by G-phase nucleation and growth in ferrite and $M_{23}C_6$ precipitation on ferrite-austenite boundaries, provides a good explanation of the complex behavior of the activation energy (ranging from 18 to 55 kcal/mole) regardless of grade, chemical composition, or fabrication process. 27 refs., 13 figs., 6 tabs.

2826 (CONF-8911114–1) **Effects of environmental variables on fatigue crack growth rate in steel immersed in seawater.** Ouchi, Hiroshi; Kobayashi, Jun-ichi. Nippon Steel Corp., Sagamihara, Kanagawa (Japan). [1989]. 9p. From EVALMAT '89: International conference on evaluation of materials performance in severe environments; Kobe (Japan); 20-23 Nov 1989. Order Number DE90002155. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI.

Effects of various environmental variables on the fatigue crack growth rate (FCGR) in a 660 MPa tensile strength steel were investigated. Applied potentials of −0.8 V and −0.6 V (vs SCE) and removals of dissolved oxygen and salts did not influence the FCGR in synthetic seawater. Increase of water contents accelerated FCGRs in alcohols. Acceleration of fatigue crack propagation was observed in several nonaqueous liquids. However, the FCGR in 1,1,2-trichloro-1,2,2-trifluoroethane was almost equal to that in air. Therefore, it was considered that the acceleration was not caused by corrosion reactions. Hydrogen atoms dissociated from water or other substances can cause the acceleration. 15 refs., 9 figs.

2827 (DOE/CE–0256-1) **Steel initiative: Development of superplastic steel processing: First annual progress report, March 15, 1988–March 15, 1989.** Sherman, D.H.; Leach, J.M.; Hayes, A.F.; Lemsky, J.A.; Thomas, J.D.; Geiger, G.H.; Goldberg, A.; Strum, M.J.; Sherby, O.D. USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (USA). Office of Industrial Programs. Sep 1989. 16p. Sponsored by U.S. DOE Conservation & Renewable Energy. Order Number DE90003277. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The influence of aluminum content and thermomechanical processing steps on developing fine microstructures in ultrahigh carbon steels (UHCS) was examined. The presence of aluminum results in ultrafine pearlitic structures without proeutectoid carbide networks, and greatly retards the eutectoid transformation kinetics. This retardation facilitates processing, which involves various combinations of DET and DETWAD steps. By applying the transformation kinetics as a guide, uniform through-thickness microstructures and superplastic properties are readily obtainable in thick sections. Superplasticity studies revealed that superplastic behavior is enhanced by aluminum additions and by increasing the amount of warm deformation during DETWAD processing. This trend is attributed to a decrease in ferrite grain size and an increase in the ferrite-grain-boundary angle, and hence, to an increase in the ease of grain-boundary sliding. Studies on the cold-rolling characteristics of a UHCS-Al alloy reveal that it can be cold-rolled to 50% in the fully pearlitic condition without annealing, and to over 60% in the fully spheroidized condition. Room-temperature tensile properties were obtained on DETWAD-processed material. Identical properties were obtained in the rolling and transverse directions, which is attributed to the ultrafine, isotropic microstructure. Two trial strand-casting runs were initiated. Modified Fe-C diagrams incorporating aluminum and/or silicon additions were constructed. Materials have been processed both at LLNL and at Ladish for evaluation of their die-filling capability.

2828 (DOE/ER/13277–T2) **Comprehensive characterization studies of sulfided molybdenum catalysts: Final progress report.** Massoth, F.E. Utah Univ., Salt Lake City, UT (USA). Dept. of Fuels Engineering. 17 Oct 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER13277. Order Number DE90002770. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objectives of this research were: to characterize a number of alumina-supported sulfided molybdena catalysts and determine hydrodesulfurization activity with the aim of relating catalytic activities to catalyst properties, viz., structure, dispersion, active sites of the active Mo phase; to determine the effect of various additives to the alumina support on the above; and to develop preparation techniques to achieve higher activity catalysts. This report reviews the progress made during the final reporting period.

2829 (DOE/ER/45182–5) **Investigation of fracture toughness and fracture mechanisms using acoustic emission measurements: Progress report, 1 March 1989–28 February 1990.** Carpenter, S.H. Denver Univ., CO (USA). Dept. of Physics. Oct 1988. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER45182. Order Number DE90002163. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this report is to provide a presentation and discussion of results and goals accomplished to date on the research program "Investigation of Fracture Toughness and Fracture Mechanisms using Acoustic Emission Measurements." The time period for this report is 1 March 1989 through 28 February 1990, which corresponds with the second year of the program. The research program consists of three separate but closely related investigations. Both the effort expended and progress achieved have closely paralleled the plan laid out in the original proposal. For two of the investigations, ductile tearing/microvoid coalescence and influence of large changes in microstructure, the majority of the experimental work has been completed and a strong effort is now being directed towards analysis of the data which has been generated. It is projected that both of these investigations will be completed early in the third year of the program. The third investigation, second phase particles, is also well underway and should be completed by the end of the third year. A small effort studying cathodic charging of 304 stainless steel has been maintained. This work is essentially completed and will be written up and published soon. A more complete discussion of each of the separate investigations is provided below. 13 figs.

2830 (DOE/OR/21400–T401) **The optical properties of beryllium.** Arakawa, E.T.; Callcott, T.A.; Chang, Yun-Ching. Oak Ridge National Lab., TN (USA). [1989]. 31p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC05-84OR21400. 1855-1562-A1. Order Number DE90002720. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We review the published data on the optical properties of beryllium for the spectral region from 0.03 to 300 eV. In the visible and infrared spectral regions, where published data from various authors show very large variations, we have performed experiments that identify the most probable sources of error, and use this information to select the best data from published sources. The effects of surface oxide overlayers have also been studied. In the far infrared spectral region, where only normal incidence reflectance data are available, and in the extreme ultraviolet, where only transmission data are available, there is insufficient information to fully determine the optical properties at each photon energy. Between 0.06 and 26 eV, however, a normal incidence reflectance curve is fully determined. This curve has been used for a Kramers-Kronig analysis to determine the optical properties in this spectral range. 9 refs., 13 figs., 3 tabs.

2831 (EGG-M–37087) **Low cross-section Mo-Nb thermocouples for nuclear application: The state-of-the-art.** Wilkins, S.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 19p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-880122–24: 5. symposium on space nuclear power systems, Albuquerque, NM (USA), 11-14 Jan 1988). Order Number DE90002078. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Long-term high-temperature measurements in nuclear environments have long posed difficult problems. The tungsten-rhenium alloy thermocouples typically used in such applications undergo large decalibrations resulting from nuclear transmutation of the component materials. An alternative thermocouple, comprising pure molybdenum and niobium thermoelements, is virtually immune to transmutation effects, but is limited in utility by other properties. Thermocouples composed of molybdenum-niobium alloys show promise of significant improvement over the pure-metal combination. The W-Re decalibration problem is detailed and the status of Mo-Nb thermocouple development reviewed, including recent efforts at the Idaho National Engineering Laboratory. 18 refs., 4 figs.

2832 (EGG-M–88357) **The biocorrosion of copper by biopolymers as examined in situ, in real time FT-IR/CIR/ATR in conjunction with pre and post XPS/AES.** Gianotto, A.K.; Wichlacz, P.L.; Jolley, J.G.; Hankins, M.R.; Geesey, G.G.; Wright, R.B. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-890238–5: Annual meeting and exhibit of the Society of Mining Engineers, Inc., Las Vegas, NV (USA), 27 Feb - 2 mar 1989). Order Number DE90002086. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Thin films of copper [2.0 nm on germanium internal reflection elements (IREs) and 3.4 nm on germanium discs] were exposed to 10% gum arabic (aqueous solution), 2% alginic acid (aqueous solution), 1% bacterial culture supernatant (BCS, simulated seawater solution) and 0.5% Pseudomonas atlantica exopolymer (simulated seawater solution). The IREs were monitored in situ, in real time using fourier transform infrared/cylindrical internal reflection/attenuated total reflection spectroscopy as a function of time at ambient conditions. The discs were characterized (pre- and post-exposure) by x-ray photoelectron and Auger electron spectroscopies. Ancillary graphite furnace atomic absorption spectroscopy was used to monitor the removal process of the copper thin film from the germanium substrates. Results indicate that Cu was oxidized by gum arabic, alginic acid and BCS. Furthermore, Cu was removed from the Cu/Ge interface by all four polymers. The Cu was found associated with the polymer solutions. 20 refs., 6 figs., 1 tab.

2833 (EGG-M–88501) **Experience with J testing of 304/308 stainless steel weldment.** Graham, S.M.; Lloyd, W.R.; Reuter, W.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract AC07-76ID01570. (CONF-8911118–1: 2. symposium on user experience with elastic-plastic test methods, Orlando, FL (USA), 8-9 Nov 1989). Order Number DE90002046. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Crack initiation toughness tests were conducted using the J-Integral as a fracture characterizing parameter according to the ASTM Standard Test Method for J_{Ic}, A Measure of Fracture toughness, E813-87. The specimens were made from a weldment of 304 stainless steel (SS) base metal and 308 SS weld metal, and were fabricated such that the crack initiation toughness (J_{Ic}) of the weld metal could be measured. A peculiar feature of all of the tests was that crack growth occurred in an inverse tunneling mode. The provisional initiation toughness (J_Q) calculated from the test results were determined to be invalid because the validation requirements on change in crack front curvature and on accuracy of the predicted crack extension were not met. The accuracy of the predicted extensions was improved by applying correction factors to the measured compliances to account for crack front curvature, plastic deformation, friction, and indention. The excessive change in crack front curvature was caused by the transition from tunneling growth during fatigue precracking (before the specimens were side grooved) to inverse tunneling during slow stable crack growth. Crack growth by inverse tunneling may indicate a constraint condition higher than plane strain at the root of the side-grooves. If this is the case, the overall stress state is more severe than plane strain, and the measured initiation toughness should be a valid indication of the lower bound for high constraint. 9 refs., 11 figs.

2834 (EGG-M–89209) **Noncontacting laser ultrasonic generation and detection at the surface of molten metal.** Garcia, G.V.; Carlson, N.M.; Telschow, K.L.; Johnson, J.A. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC07-76ID01570. (CONF-890770–4: Conference on review of progress in quantitative NDE, Brunswick, ME (USA), 23-28 Jul 1989). Order Number DE90002020. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes proof of principle for using lasers to generate and detect ultrasound for the measurement of molten pool depth. Tin was chosen for these experiments because it has a low melting point and does not require any special equipment to produce a molten metal pool. To keep initial experiments simple, the depth of the molten pool was determined using a noncontacting sensor without any solid/liquid interfaces present. The results are compared to data available from experiments that used buffer rods to determine properties of molten tin. 5 refs., 6 figs.

2835 (GKSS–89/E/16) **The consideration of irradiation embrittlement of RPV steels in German licensing rules as compared to recent results of irradiation experiments.** Ahlf, J.; Bellmann, D.; Schmitt, F.J.; Pott, G. GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). 1989. 12p. Available from Reprint from Nucl. Eng. Des. (Mar 1989) v. 112 p. 155-164.

After a brief outline of the consideration of irradiation embrittlement of RPV steels in the pertinent German KTA licensing rules, the prerequisites of the licensing procedure are identified and addressed in the light of recent results, mainly from the Research Program Safety of Components. It is stated that the $T_{41\ J}$ shift can be determined reliably and reproducibly and that measured shifts are conservatively predicted by the trend lines of KTA 3203. It is further shown that the $T_{41\ J}$ shift is generally greater than the T_{NDT} shift and that the measured reference temperature RT_{NDT} in the irradiated state compares reasonably well with the adjusted reference temperature RT_{NDT}. Experimental K_{Ic}/K_{Jc} values for two steels unirradiated and irradiated have been found to scatter largely but lie always far left from the corresponding lower bound K_{Ic} curves. Preliminary results and ongoing research programmes are briefly discussed with respect to the influence of neutron energy spectrum and flux density on embrittlement. (orig.).

2836 (INIS-BR–1689) **EVP2D- a computer code developed for the eslastoviscoplastic-damage analysis of axyssimetrical and two-dimensional problems.** Goncalves Filho, O.J.A. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Mecanica Estrutural. 1987. 4p. (In Portuguese). (CONF-871288–: 9. Brazilian congress of mechanical engineering, Florianopolis (Brazil), 7-11 Dec 1987). Order Number DE90607970. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

This work aims to describe the computer code EVP2D developed for the elastoviscoplastic-damage analysis of metallic components, with particular emphasis dedicated to the problem of creep damage and rupture. After a brief introduction of the basic concepts and procedures of Continuum Damage Mechanics, the constitutive equations implemented are presented. Next, the finite element approximation proposed for solution of the initial boundary value problem of interest is discussed, particularly the numerical algorithms used for time integration of the creep strain rate and damage rate equations, and the numerical procedures adopted for dealing with the presense of partially or fully ruptured finite elements in the mesh. As a pratical application, the rupture behaviour of a biaxially tension loaded plate containing a central circular hole is examined. Finally, future developments of the code, which include as priorities the treatment of ciyclic loads and the description of the anisotropic feature of creep damage evolution, are briefly introduced. (author).

2837 (INIS-BR–1765) **Study of niobium corrosion in alkaline medium.** Almeida, S.H. de. Sao Paulo Univ., SP (Brazil). Inst. de Quimica. 1987. 151p. (In Portuguese). Order Number DE90607994. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

A comparative study of niobium electrochemical behaviour in NaOH and KOH solution, with concentrations between 0,5 and 6,1M is presented. The studies were done through electrochemicals assays, consisting in the corrosion potential and anodic and cathodic polarization curves, complemented by loss of mass experiments. The niobium anodic behaviour in alkaline medium is characterized by passivation occurrence, with a stable film formation. The Na oH solution in alkaline medium are more corrosible to niobium than the KOH solution. The loss of mass assays showed that the corrosion velocit is more dependente of hydroxide concentration in KOH medium than the NaOH medium. (C.G.C.).

2838 (JAERI-M–89-063) **Estimation of thermodynamic properties of alloys from phase diagram and other loose boundary conditions.** Ogawa, Toru; Iwai, Takashi. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1989. 50p. (In Japanese). Order Number DE90719511. Available from NTIS (US Sales Only), PC A03/MF A01.

A set of computer programs has been made, which is used to predict thermodynamic properties of an alloy system from phase diagram and other loose boundary conditions. 'Loose' boundary conditions include fragmentary thermodynamic data and predictions based on several empirical or theoretical hypotheses. In program 'TOHSG', m equations with n ($m>n$) unknowns which are parameters concerning atomic interactions are assembled from the equilibria collected on experimental phase diagram, and also from the 'loose' boundary conditions. Then, the unknowns are obtained as Chebyshev solutions. Thermodynamic properties of the alloys are also calculated. In order to test their validity, the parameters are then fed into the other two programs 'TOGAP' and 'TOCOMP', which calculate the phase diagram. The set of programs can (1)

generate a working data set of a system whose thermodynamic properties are unknown, and (2) test various hypotheses against experimental data such as phase diagrams. As an example of application, U-Zr system has been analyzed. Source list of 'TOHSG' and input/output guides are attached. (author).

2839 (JYFL-RR-2/1987) **Hydrogen and helium in metals: positron lifetime experiments. Quarterly report 3. quarter 1987.** Rajainmaeki, Hannu. Jyvaeskylae Univ. (Finland). Dept. of Physics. Sep 1987. 61p. Order Number DE90008000. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

This thesis reviews a new approach to studying the role of hydrogen and helium in defect recovery of metals by the positron lifetime technique. A cryostat has been built at the University of Jyvaeskylae for irradiating and/or implaning solids by high-energy proton or helium beams from the MC-20 cyclotron. The samples can be kept continuously below 20 K and the isochronal annealings and the subsequent positron lifetime measurements are carried ou in the same cryostat after the irradiations. During the implantations below 20 K both impuities (H or He) and Frenkel pairs are produced simultaneously. By measuring positron lifetimes during the annealing detailed information is obtained about radiation damage, impurity-defect interactions, lattice defect annealing, void nucleation and formation of helium bubbles. In this work positron lifetime spectroscopy has been utilized for the first time to study defect recovery below the liquid nitrogen temperature (77 K). The annealing stages are investigated in aluminium, nickel and molybdenum in the temperature range 20-700 K. Hydrogen is found to get trapped at vacancies in all the studied metals with binding energies 0.53+-0.04 and 1.6+-0.1 eV, respectively. Trapped hydrogen retards the vacancy migration in Al and Mo, while H-vancancy pairs dissociate in Ni below the free vacancy migration stage. helium gets deeply trapped at vacancies in Al and migrates substitutionally with the activation energy of 1.3+-0.1 eV. Helium-vacancy pairs are observed to nucleate into clusters and form helium bubbles which are stable up to the Al melting temperature. The growth mechanisms for the bubbles are established as thermal vacancy absorption and bubble migration/coalescence.

2840 (LBL-27380) **Effects of precipitate distribution on 293 K and 77 K properties of 2090-T81 weldments.** Sunwoo, A.J.; Miyasato, S.; Morris, J.W. Jr. Lawrence Berkeley Lab., CA (USA). Jun 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890701-16: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90002332. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Although 2090-T81 precipitation behavior has been well documented, the weld precipitation behavior has not been as-well characterized. The purpose of this study is to characterize the EB and GTA fusion zone precipitates and their distribution and to correlate the microstructure to 293 K and 77 K properties. The base metal strengths are greatly enhanced by a homogeneous distribution of T_1 precipitates at 293 K and 77 K, but the presence of T_1 and T_2 at the boundaries has an adverse effect on the elongation at 77 K. The weld strengths are limited by a lack of strengthening precipitates. Fusion zone embrittlement is caused by the formation of Cu-Fe containing film and strain localization at the dendrite boundaries. 14 refs.

2841 (LBL-27834) **Aspects of faceting in the study of percipitate interfaces.** Dahmen, U.; Witcomb, M.J.; Westmacott, K.H. Lawrence Berkeley Lab., CA (USA). Jul 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890977-2: International congress on intergranular and interphase boundaries in materials, Paris (France), 4-8 Sep 1989). Order Number DE90003113. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The role of faceting in the formation of interface structures between a precipitate and its matrix is considered and illustrated with TEM observations on a number of different alloy systems. Crystal symmetry and elastic constraints from the solid matrix are shown to be important factors in the development of morphologies and interfacial structures. 14 refs., 9 figs.

2842 (N-89-17298, pp. 289-298) **Anisotropic constitutive modeling for nickel base single crystal superalloy Rene N4 at 982 C.** Stouffer, D.C.; Jayaraman, N.; Sheh, M.Y.; Alden, D. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP-2493;E-3745;NAS-1.55:2493;CONF-8710466-: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

A back stress/drag stress constitutive model based on a crystallographic approach to model single crystal anisotropy is presented. Experimental results demonstrated the need for the back stress variable in the inelastic flow equations. Experimental findings suggested that back stress is orientation dependent and controls both strain hardening and recovery characteristics. Due to the observed stable fatigue loops at 1800 F, drag stress is considered constant for this temperature. The constitutive model operated with constraints determined only from tensile data was extensively tested from simple tensile and fatigue to complicated strain hold tests. The model predicted very well under those conditions.

2843 (N-89-17298, pp. 299-301) **Constitutive modelling of single crystal and directionally solidified superalloys.** Walker, K.P. (Connecticut Univ., Storrs (USA)); Jordan, E.H. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP-2493;E-3745;NAS-1.55:2493;CONF-8710466-: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

Successful attempts were made to model the deformation behavior of nickel base superalloys to be used in gas turbine engines based on both a macroscopic constitutive model and a micromechanical formulation based on crystallographic slip theory. These models were programmed as FORTRAN subroutines, are currently being used to simulate thermomechanical loading predictions expected at the fatigue critical locations on a single crystal turbine blade. Such analyses form a natural precursor to the application of life prediction methods to gas turbine airfoils.

2844 (N-89-17298, pp. 317-334) **Preliminary study of creep thresholds and thermomechanical response in Haynes 188 at temperatures in the range 649 to 871 C.** Ellis, J.R.; Bartolotta, P.A.; Mladsi, S.W. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP-2493;E-3745;NAS-1.55:2493;CONF-8710466-: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The following conclusions were drawn from this study of creep thresholds and thermomechanical response: (1) creep threshold can be determined using the latest electrohydraulic test equipment, providing that test durations are short and relatively large accumulations of creep strain are used in defining the threshold; (2) significant creep strains were measured under monotonic loading as stress levels as low as 4 ksi at temperatures predicted for solar receiver service; and (3) the material exhibited creep ratchetting during simulated service cycles, a result not predicted by analysis using current constitutive models for Haynes 188.

2845 (N-89-17298, pp. 401-412) **High temperature constitutive and crack initiation modeling of coated single crystal superalloys.** Meyer, T.G.; Nissley, D.M.; Swanson, G.A. National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center. Oct 1987. (NASA-CP-2493;E-3745;NAS-1.55:2493;CONF-8710466-: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The purpose of this program is to develop life prediction models for anisotropic materials used in gas turbine airfoils. In the base portion of the program, two coated single crystal alloys are being tested. They are PWA 286 overlay coated and PWA 273 aluminide coated PWA 1480 and PWA 286 overlay coated Alloy 185. Viscoplastic constitutive models for these materials are also being developed to predict the cyclic stress-strain histories required for life prediction of the lab specimens and actual airfoil designs.

2846 (N–89-17298, pp. 435-458) **Total strain version of strainrange partitioning for thermomechanical fatigue at low strains.** Halford, G.R.; Saltsman, J.F. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

A new method is proposed for characterizing and predicting the thermal fatigue behavior of materials. The method is based on three innovations in characterizing high temperature material behavior: (1) the bithermal concept of fatigue testing; (2) advanced, nonlinear, cyclic constitutive models; and (3) the total strain version of traditional strainrange partitioning.

2847 (PB–89-865075/XAB) **Tungsten and tungsten-alloy powder metallurgy: Powder production and applications-excluding lamps. November 1971-July 1989 (Citations from the US Patent data base). Report for November 1971-July 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 35p. Available from NTISPC N01/MF N01.

This bibliography contains citations of selected patents concerning the preparation of metallic and ceramic powders of tungsten and tungsten alloys including various applications of these materials. The hydrogen reduction of tungsten compounds together with alloying-element compounds produce forms with characteristics of high density, hardness, wear resistance, high melting points, and abrasiveness. Topics include production of various cathodes, heaters, filament wires, electrical contacts, acoustic absorbers, high-density sheets and coatings, hard penetrators, and tungsten carbide and metallized ceramics. Tungsten halogen lamps are examined in a separate bibliography. (Contains 60 citations fully indexed and including a title list.)

2848 (PB–89-871263/XAB) **Corrosion-resistant coatings. February 1983-September 1989 (Citations from the NTIS data base). Report for February 1983-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 203p. Available from NTISPC N01/MF N01.

Supersedes PB–88-852504.

This bibliography contains citations concerning the technology and applications of corrosion-resistant coatings. Among the coatings discussed are antifouling, antireflecting, plastic, ceramic and metal coatings. Applications include nuclear reactors and underwater equipment and materials. Military utilization is also included. (This updated bibliography contains 383 citations, 132 of which are new entries to the previous edition.)

2849 (PNL-SA–17443) **Acoustic emission during intergranular stress corrosion cracking.** Freisel, M.A.; Jones, R.H. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-890770–6: Conference on review of progress in quantitative NDE, Brunswick, ME (USA), 23-28 Jul 1989). Order Number DE90002894. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The physical and chemical processes taking place during intergranular stress corrosion cracking (IGSCC), in particular the effects of impurities on cracking mechanisms, have been the subjects of a research program sponsored by the Division of Materials Science, Office of Basic Energy Science, US Department of Energy at Pacific Northwest Laboratory (PNL), operated by Battelle Memorial Institute. Acoustic emission (AE) was brought into the program because of the unique ability of AE methods to detect dynamic microscopic fracture processes. In this paper, the results of these tests are presented. 7 refs., 6 figs., 3 tabs.

2850 (PPA-T–84) **Effect of heat treatment of toughness and strength properties of C-Mn steel.** Mohamad bin Harun; Goh Kian Seong; Yasmin binti Baba. Unit Tenaga Nuklear, Bangi, Selangor (Malaysia). [1989]. 11p. Order Number DE90607971. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The strength and toughness of the heat-treated and tempered C-Mn are studied. Two type of heat-treatments have been carried out with the specimens in an argon gas. The variation in the fracture surfaces of the heat-treated and tempered specimens with impact test temperatures also is discussed. (author).

2851 (PPLK-R–30) **Phase properties of the rapid cooled palladium-silicon alloy in the concentration range 40 to 58 at.% Si.** Tsumori, K.; Akimune, H. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Oct 1988. 36p. Order Number DE90719525. Available from NTIS (US Sales Only), PC A03/MF A01.

The phase diagram for Pd-Si system is reinvestigated by thermal analysis with a method taking the second derivative of time dependent temperature and by metallographic measurement, where the cooling rate is about 140degC/min. The second derivative offers a sensitive and accurate means for the thermal analysis with aid of micro-computer. The intermetallic compound PdSi has no temperature peak in the phase diagram. In the Si concentration higher than 50 at.%, the alloy appears to be the eutectic for the constitutions of PdSi and Si, and the eutectic point locates at 895degC and 50 at.% of Si, and in the Si concentration lower than 50 at.%, the alloy appears to be the eutectic for the constitutions of Pd_2Si and PdSi, and the eutectic point locates at 886degC and about 48.5 at.% of Si. The phase properties appear to be largely affected by the phase stability of PdSi in company with the departure from thermal equilibrium in the thermal analysis. The addition of Ag impurity of small amount collapses PdSi phase and the alloy appears to be the eutectic for the constitutions of Pd_2Si and Si in the concentration range from Pd_2Si to Si. (author).

2852 (SAND–89-1665C) **Surface and bulk properties which influence ion-beam hydrogenation of silicon.** Anderson, R.A.; Seager, C.H. Sandia National Labs., Albuquerque, NM (USA). [1989]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891119–9: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003153. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The time evolution of dopant passivation in p and n-type silicon Schottky and MIS barriers has been investigated for low-energy H ions implanted directly into the silicon through a 400-Å front-electrode metallization. Knowledge of the dependence of the near-surface hydrogen concentration on time and experimental parameters is crucial to the analysis of these experiments. Hydrogenation effects are observed to vanish at ion energies below 800 eV, which suggests that the front electrode, rather than being a source of H, will behave as a sink for H diffusing in the silicon. Accordingly, we show that a steady-state H concentration proportional to the ion-deposition flux and deposition depth is established in a time interval less that a second near the electrode. Although some of the mobile H appears to be in a positively charged state, we calculate that the bias voltage applied to samples has only a small influence on the near-surface H concentration. An extensive study of the effects of sample temperature, beam flux, and ion energy supports these concepts and has revealed no evidence of ion-damage induced H trapping. The possible importance of H·H recombination of suggested by data obtained at the higher H concentrations. 4 refs., 4 figs.

2853 (SAND–89-1711C) **In-situ ion beam measurements of deuterium loading in thin foil electrochemical cells.** Knapp, J.A.; Guilinger, T.R.; Kelly, M.J.; Walsh, D.; Doyle, B.L. Sandia National Labs., Albuquerque, NM (USA). [1989]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891119–8: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003162. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A key element of recent assertions of "cold fusion" has been the claim that electrochemical loading of deuterium into Pd electrodes can produce D:Pd levels exceeding 1:1. Using external beam nuclear reaction analysis of Pd foil electrodes in operating electrochemical cells, we have directly monitored deuterium content in-situ. No conditions were found which resulted in loadings higher than ~0.9. 15 refs., 5 figs.

2854 (SVF–339) **Sensitivity to hydrogen embrittlement in connection with cathodic protection of stainless duplex steels.** Henrikson, S. Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden). May 1989. 55p. (In Swedish). Order Number

DE90719409. Available from NTIS (US Sales Only), PC A04/MF A01.

Hydrogen embrittlement tests have been carried out at 25 deg C under cathodic protection in a water solution of 3.5% NaCl. The stainless steels 254 SMO (austenitic), MONIT (ferritic), SAF 2205 (ferritic-austenitic) and SAF 2507 (ferritic-austenitic) were studied. The primary aim of the investigation was an assessment of the hydrogen embrittlement susceptibility of the duplex steel SAF 2507 when used as tube material in cathodically protected seawater cooled heat exchangers. Two methods were used for the testing. The first was exposure of flattened tube specimens at various cathodic potentials. Titanium Grad 2 was also involved as a reference material in these tests. The second test method was SSRT-testing at a strain rate of 10^{-6}/s under cathodic protection and in air. The tests resulted in the following ranking of the materials regarding their susceptibility to hydrogen embrittlement: Least susceptible; * 254 SMO - no brittle fracture, * Titanium - no cracking probably due to surface hydriding, * SAF 2507 - inter- and transgranular cracking, * SAF 2205 - inter- and transgranular cracking. Most susceptible; * MONIT - intergranular cracking. Tests carried out with flattened tube specimens indicate that there is no risk of cracking by hydrogen embrittlement in tubes of the duplex steel SAF 2507 at cathodic protection of carbon steel parts (-800mV/SCE) of seawater cooled heat exchangers.

2855 (UCRL–98780) **Effects of nitrogen pulsing on sputter-deposited beryllium films.** Hsieh, E.J.; Price, C.W.; Pierce, E.L.; Wirtenson, G.R. Lawrence Livermore National Lab., CA (USA). 9 Aug 1989. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891093–13: 36. American Vacuum Society national vacuum symposium, Boston, MA (USA), 23-27 Oct 1989). Order Number DE90003058. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Beryllium films have been used as a "heat sink" layer between the reflective coating of a mirror and its glass substrate to improve the mirror's radiation resistance to prompt deposition of x-rays. Under x-ray irradiation, the beryllium "heat sink" layer is subjected to tensile stresses caused by differences in thermal expansion coefficients. Test results indicated that the predominant failure mode was the film's crazing under tensile stress. The inherent columnar structure of the beryllium films deposited under normal conditions in detrimental to the tensile strength of the films and may be responsible for this type of failure. We successfully suppressed the inherent columnar growth in beryllium films by incorporating periodic N_2 pulses during sputter deposition. Quantitative analyses were conducted for nitrogen and oxygen contamination in the beryllium films using standards prepared by ion implantation. Secondary ion mass spectroscopy (SIMS) depth profiles were obtained for oxygen and nitrogen using mass isotopes ^{16}O and 23(^{9}Be + ^{14}N).

2856 (UCRL–100797) **Analyses of particles in beryllium by ion imaging.** Price, C.W.; Norberg, J.C. Lawrence Livermore National Lab., CA (USA). 6 Oct 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8909172–3: SIMS VII: 7th international conference on secondary ion mass spectrometry, Monterey, CA (USA), 3-8 Sep 1989). Order Number DE90001895. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Ion microanalysis using a $^{133}Cs^{+}$ primary ion beam and SIMS has sufficiently high sensitivity that it can be used to analyze Be for trace amounts of most elements. High sensitivity is important, because O, C, and other elements have low solubilities in Be, and reliable analyses of these elements becaome difficult as they approach their solid solubility limits (about 6 appm for O; C also is suspected to be within this range). Because of the low solubilities of these elements, major portions of their total concentrations can be contained in particles. Quantitative depth-profile analyses using ion-implanted standards are ideal to analyze the Be matrix, but if particles exist, supplementary techniques such as stereology are required to determine the amounts of the elements that are associated with the particles. This paper will demonstrate the use of ion imaging to identify various types of particles and determine their spatial distributions. 4 refs., 3 figs.

2857 **Fundamentals of beam-solid interactions and transient thermal processing.** Materials Research Society symposium proceedings. Volume 100. Aziz, M.J.; Rehn, L.E.; Stritzker, B. 763p. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes a line-source electron-beam system used to heat thin surface layers of metastable phases at a rate which precludes solid-state transformations to stable phases, thus permitting the observation of melting transitions normally missed with slow heating. A detailed example of a new approach to this method is shown for metastable icosahedral Al-Re and crystalline Al_6Re.

2858 **The projectile mass dependence of the amorphization process and the critical temperature in the ion irradiated CuTi.** Koike, J. (Northwestern Univ., Evanston, IL (US)); Meshii, M. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

CuTi was irradiated with 1MeV Ne^{+} and Kr^{+} at various temperatures in the Argonne-HVEM interfaced to a tandem accelerator. The integrated intensity of diffuse ring was measured by a microdensitometer and analyzed by Gibbons model for the dope dependence of the amorphous volume. The results are discussed in this paper. They indicate that the direct amorphization occurs in a single damage zone with Kr^{+}, but the overlapping of three damage zones is necessary with Ne^{+}. Using the present observations, the relation between the amorphization process and the critical temperature is discussed.

2859 **Ion-beam mixing and amorphization in Au/Zr bilayers.** Ding, F.R. (Argonne National Lab., Argonne, IL (US)); Okamoto, P.R.; Rehn, L.E. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-31-109-ENG-38. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes Au/Zr bilayer films with inert-gas markers produced by low energy ($\lesssim$4 KeV) implantation. Mass transport was measured during ion-beam mixing with 1 MeV Kr at several temperatures between 330 and 540K. Two distinct regimes of apparent Arrhenius behavior were found with activation enthalpies of 0.06 and 0.9 eV in the temperature range 330-440K and 460-540K, respectively. Microstructural changes during ion-beam mixing were studied in situ, in a high voltage electron microscope. Heterogeneous nucleation of an amorphous phase was observed during mixing. The results are compared with similar studies reported previously in Ni/Zr bilayer specimens.

2860 **Formation of metastable structures and amorphous phases in Cu-W alloys using the triode sputtering technique.** Rizzo, H.F. (Lawrence Livermore National Lab., Livermore, CA (US)); Tanner, L.E.; Wall, M.A.; Massalski, T.B.; McClanahan, E.D. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-7405-ENG-48. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes the triode sputtering technique and a "split-target" arrangement used to produce metastable crystalline and amorphous phases in the Cu-W system under essentially oxygen-free conditions. Large metastable extensions of solid solubility were observed both from the Cu (fcc) and W (bcc) sides of the phase diagram, and a wide range of metallic glass formation was observed, approximately between 30 and 65 at.%W. The thickness of the amorphous Cu-W phase (40-160 μm) that can be deposited without the formation of the metastable bcc phase appears to be dependent on the Cu-W alloy composition. On heating, the crystallization temperature of the amorphous alloys was higher than 350^{0}C. The behavior of the lattice parameter and near-neighbor distance has been studied with x-ray diffraction, showing small positive deviations from an assumed Vegard's Law. Hardness measurements indicate

that the metastable crystalline phases are relatively harder than the amorphous phase.

2861 Elastic instability during amorphization of intermetallic compounds by charged-particle beams. Okamoto, P.R. (Argonne National Lab., Argonne, IL (US)); Rehn, L.E.; Pearson, J.; Bhadra, R.; Grimsditch, M. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-31-109-ENG-38. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

Transmission electron microscopy (TEM) and Brillouin scattering methods were used to determine the lattice dilatation and shear elastic constant as a function of the degree of long-range order during room temperature irradiation of Zr_3Al with 1.0-MeV Kr^+. The results are described in this paper. It is shown that the volume dependence of the shear elastic constant associated with radiation-induced disordering and amorphization in virtually identical to that associated with the heating to melting of many metals.

2862 In situ ultrahigh vacuum friction measurement and wear track analysis of ion implanted 304 stainless steel. Pope, L.E. (Sandia National Labs., Albuquerque, NM (US)); Follstaedt, D.M.; Knapp, J.A.; Barbour, J.C. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper discusses the dual ion implantation of Ti and C into 304 stainless steel found to reduce friction and wear in ultrahigh vacuum (UHV). The implantation treatment producing this result, 4.6 x 10^{17} Ti/cm^2 (180 keV) followed by 2.0 x 10^{17} c/cm^2 (50 keV), produced TiC precipitates dispersed in an amorphous surface layer. Friction and wear track compositions were measured in situ with a scanning Auger microprobe without removing the pin from the track. This treatment is described.

2863 Characteristics of hydrogenated amorphous silicon-germanium alloys. Luft, W. (Solar Energy Research Inst., Golden, CO (USA)). pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC02-83CH10093. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

In this paper literature data are summarized for hydrogenated amorphous silicon-germanium (a-SiGe:H and a-SiGe:H:F) alloys that show the relation between germanium content, hydrogen content, deposition methods, feed gas mixture, and other deposition parameters, and properties such as the optical band gap, dark and photoconductivities, photosensitivity, Urbach parameter, and spin density. Examining RF glow discharge with both a diode and a triode geometry, DC proximity glow discharge, and photo-CVD, using various hydrogen-diluted and undiluted gas mixtures, one observes that hydrogen (or inert gas) dilution is essential for obtaining high photosensitivity in SiGe alloys (in contradistinction to a-Si:H).

2864 Temperature dependence of Kr precipitation in Ni. Birtcher, R.C. (Materials Science Div., 9700 S. Cass Ave., Argonne National Lab., Argonne, IL (US)); Liu, A.S. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-31-109-ENG-38. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes a study of the precipitation of Kr injected into Ni at temperatures between 25 and 560 C with transmission electron microscopy. The Kr precipitates in cavities which increase in size with Kr fluence. Electron diffraction and dark-field imaging demonstrate that small Kr precipitates are solid, fcc crystals aligned with each other and the Ni lattice. The Kr is held in the solid state by the pressure generated by the cavity walls, and this pressure decreases with increasing cavity size. The mismatch between the Kr and Ni lattices is as large as 55%.

2865 Phase selection in undercooled liquids of pulsed-laser melted alloys. Follstaedt, D.M. (Sandia National Labs., Albuquerque, NM (US)); Peercy, P.S.; Perepezko, J.H. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

In this paper the use of thermodynamic analysis of phase relationships to identify metastable conditions for generating undercooled liquids by pulsed laser melting, and to interpret the resulting microstructures is illustrated from studies of Mn, FeV and TiAl. Phases with simple, disordered structures are found to nucleate and grow within tens of nanoseconds in liquids undercooled by 50-100 K. An extended transformation depth is found in which the stable high-temperature α phase replaces the metastable σ phase in FeV due to the heat release from the rapidly forming α phase.

2866 Excimer laser mixing of titanium layers on AISI 304 stainless steel. Jervis, T.R. (Los Alamos National Lab., Los Alamos, NM (US)); Nastasi, M.; Zocco, T.G. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-7405-ENG-36. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes excimer laser radiation to mix single layers of Ti directly on annealed substrates of 304 stainless steel. This process produces much thicker surface alloy layers and is much faster than ion mixing techniques. Liquid state diffusion results in mixed layers of the order of 1.0 μm thick from 0.5 μm Ti overlayers. In single pulse experiments, fluences of up to about 4 times melt threshold could be used before ablation occurred. The fluence in these experiments determines the melt duration and therefore the amount of mixing. Profiles of laser mixed surface layers and microstructural characterization of the layers are presented.

2867 Modeling of heat capacities of metals. Krikorian, O.H. (Lawrence Livermore National Lab., CA (USA)); Lai, D.Y. *Journal of Nuclear Materials, on Metallurgy, Ceramics and Solid State Physics in the Nuclear Energy Industry (Netherlands),* 167: 167 (Sep 1989). DOE Contract W-7405-ENG-48. (CONF-8809145–: Thermodynamics of nuclear materials, Chicago, IL (USA), 27 Sep 1988).

Modeling methods are developed here to obtain a generalized approach across the periodic table for calculating C_p for the metallic elements. A Debye model is used for the harmonic lattice vibration contributions with the Debye temperature given by an expression of the form $\theta_D=\theta_0[1-\exp(-C_0/T)+\exp(-C_\infty/T)]$. Expressions are also developed to describe the temperature dependent behavior of the dilatation and electronic contributions to C_p. The average deviation between calculation and experiment is found to be +-1.6% for $C_{p,298}$ and +-1.0% for derived values S^0_{298}. (orig.).

2868 High-temperature interdiffusion and phase equilibria in U-Mo. Lundberg, L.B. (Los Alamos National Lab., NM (USA)). *Journal of Nuclear Materials, on Metallurgy, Ceramics and Solid State Physics in the Nuclear Energy Industry (Netherlands),* 167: 167 (Sep 1989). (CONF-8809145–: Thermodynamics of nuclear materials, Chicago, IL (USA), 27 Sep 1988).

Experimental data for interdiffusion and phase equilibria in the U-Mo system have been obtained over the temperature range 1400 to 1525 K from analysis of compatibility experiments in which UO_2 was decomposed by lithium in closed molybdenum capsules. Composition-position, X-ray diffraction, and microstructural data from the interdiffusion zones indicate that the intermediate phase U_2Mo is formed in the temperature range, contrary to prediction from the currently accepted equilibrium U-Mo phase diagram. The U-Mo interdiffusion data generally agree with published values. Inclusion of the U_2Mo phase in a theoretical correlation of interdiffusion and phase equilibria data using Darken's equation indicates that high-temperature interdiffusion of uranium and molybdenum proceeds under conditions of local thermodynamic equilibrium. Significant changes in the value of the thermodynamic-based Darken factor

near the U_2Mo phase boundary on the high uranium side are indicated from both the new and published interdiffusion data. (orig.).

2869 Evaluation and thermodynamic analysis of phase equilibria in the U-Al system. Kassner, M.E. (Lawrence Livermore National Lab., CA (USA)); Adler, P.H.; Adamson, M.G.; Peterson, D.E. *Journal of Nuclear Materials, on Metallurgy, Ceramics and Solid State Physics in the Nuclear Energy Industry (Netherlands),* 167: 167 (Sep 1989). DOE Contract W-7405-ENG-48. (CONF-8809145–: Thermodynamics of nuclear materials, Chicago, IL (USA), 27 Sep 1988).

A reevaluation of phase equilibria in the binary U-Al system has been performed as part of the ASM-NBS Binary-Phase Diagram Evaluation Program. The resulting diagram includes several modifications to the recently assessed diagram by Chiotti et al. The current assessment also emphasizes the uranium-rich portion of the diagram. The consistency between available thermodynamic data for the system (Gibbs energies of formation of UAl_2, UAl_3, and UAl_4, and activity data for dilute solutions of uranium in liquid Al) and key points of the assessed diagram has been tested using the POTCOMP and FITBIN subroutines of the thermochemical computer code FACT. With the assumption of a regular solution model for Al-rich liquid, an ideal solution model for U-rich liquid, and Henrian models for U(β) and U(γ) solid solutions, there is reasonably good consistency between the thermo data and the assessed phase diagram. (orig.).

2870 Hydrogen effects in aluminum. Rozenak, P. (Negev Univ., Beersheba (Israel)); Siros, E.; Robertson, I.M.; Birnbaum, H.K.; Spooner, S. *Israel Journal of Technology (Israel),* 24(1-2): 183-189 (1988). (CONF-881206–: 4. Israel materials engineering conference, Beer-Sheva (Israel), 7-8 Dec 1988).

Secondary ion-mass spectrometry, small-angle X-ray scattering (SAXS), and TEM, are presently used to ascertain the effects of solute hydrogen in high purity Al. The distribution of deuterium at the surface of cathodically and chemically charged specimens produced deuterile profiles which do not agree with those calculated on the basis of diffusion data. The SAXS results have demonstrated that significant scattering is generated by the formation of clusters and small voids in the cathodically-charged Al. Anisotropic scattering was observed in the 110 and 111 line directions after cathodic charging; this, however, disppeared after aging. 16 refs.

2871 Kinetic paths of B2 and DO_3 order parameters: Theory. Anthony, L. (Department of Materials Science 138-78, California Institute of Technology, Pasadena, California 91125 (US)); Fultz, B. *Journal of Materials Research (USA),* 4(5): 1132-1139 (Sep 1989).

It is shown that a binary alloy with an AB_3 stoichiometry on a bcc lattice may develop various combinations of B2 and DO_3 order along its kinetic path toward equilibrium. The temporal evolution of these two order parameters is analyzed with an activated-state rate theory. Individual vacancy jumps are treated in a master equation formalism that involves first-nearest-neighbor (1nn) and second-nearest-neighbor (2nn) interactions. In our formulation, a set of coupled differential equations is obtained describing the time-dependence of six order parameters. These equations were integrated numerically for a variety of interatomic interactions and initial conditions. It was found that the *relative* rates of B2 and DO_3 ordering, and hence the path of the alloy through the space spanned by the B2 and DO_3 order parameters, depend on the relative strengths of the interatomic interaction potentials and on the temperature. For very strong 2nn interactions, a transient B32 structure was observed to develop at early times, although this phase disappeared as equilibrium was approached.

2872 Kinetic paths of B2 and DO_3 order parameters: Experiment. Anthony, L. (Department of Materials Science 138-78, California Institute of Technology, Pasadena, California 91125 (US)); Fultz, B. *Journal of Materials Research (USA),* 4(5): 1140-1142 (Sep 1989).

Rapidly quenched powders of Fe_3Al were subjected to thermal annealings at temperatures well below the critical temperatures for B2 and DO_3 ordering. X-ray diffractometry was used to measure the subsequent evolution of B2 and DO_3 long-range order. It was found that the relative rates of change of B2 and DO_3 order parameters were temperature dependent; hence at different temperatures the alloy passed through different states of order en route to thermal equilibrium. These temperature dependences of "kinetic paths" can be understood in terms of a theory of kinetic paths based on the kinetic master equation. The theory indicates that the temperature dependence of the observed kinetic paths originates from having first-nearest-neighbor interactions that are stronger than second-nearest-neighbor interactions. This seems consistent with previous thermodynamic analyses of critical temperatures of Fe_3Al.

2873 The dose, temperature, and projectile-mass dependence for irradiation-induced amorphization of CuTi. Koike, J. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Okamoto, P.R.; Rehn, L.E.; Meshii, M. *Journal of Materials Research (USA),* 4(5): 1143-1150 (Sep 1989). DOE Contract W-31-109-ENG-38.

CuTi was irradiated with 1-MeV Ne^+, Kr^+, and Xe^+ in the temperature range from 150 to 563 K. The volume fraction of the amorphous phase produced during room temperature irradiation with Ne^+ and Kr^+ ions was determined as a function of ion dose from measurements of the integrated intensity of the diffuse ring in electron diffraction patterns. The results, analyzed by Gibbons' model, indicate that direct amorphization occurs along a single ion track with Kr^+, but the overlapping of three ion tracks is necessary for amorphization with Ne^+. The critical temperature for amorphization increases with increasing projectile mass from electron to Ne^+ to Kr^+. However, the critical temperatures for Kr^+ and Xe^+ irradiations were found to be identical, and very close to the thermal crystallization temperature of an amorphous zone embedded in the crystalline matrix. Using the present observations, relationships between the amorphization kinetics and the displacement density along the ion track, and between the critical temperature and the stability of the irradiation-induced damage, are discussed.

2874 Effect of chromium on properties of Fe_3Al. McKamey, C.G. (Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6115 (US)); Horton, J.A.; Liu, C.T. *Journal of Materials Research (USA),* 4(5): 1156-1163 (Sep 1989). DOE Contract AC05-84OR21400.

The effects of the addition of chromium on several properties of Fe_3Al, including tensile strength and ductility, fracture behavior, and slip and dislocation characteristics, were studied. Alloying with up to 6 at.% chromium results in an increase in room temperature ductility from approximately 4% to 8–10%. Along with this increase in ductility, the addition of chromium produces a change in fracture mode from transgranular cleavage to a mixed mode of intergranular-transgranular cleavage, and a change in slip behavior from coarse straight slip to fine wavy slip. These phenomena are discussed in terms of the effect of chromium on the antiphase boundary energies and dislocation characteristics.

2875 Nucleation and propagation of cracks at grain boundaries in zinc bicrystals. Schmitz, H.A. (Department of Materials Science and Engineering, State University of New York at Stony Brook, Stony Brook, New York 11794 (US)); Dew-Hughes, D.; Bilello, J.C. *Journal of Materials Research (USA),* 4(5): 1182-1194 (Sep 1989).

A study has been made of fatigue and fracture in zinc bicrystals. It is shown that cleavage cracks are nucleated, both under tension and as a result of fatigue, in regions of multiple slip adjacent to grain boundaries at stresses below those for crack nucleation in single crystals. The nature of crack penetration through the boundary is observed as a function of orientation across the boundary. Low angle tilt boundaries are barriers to crack propagation, increasing effective surface energies for crack propagation by 1.6–2 times. Twist boundaries, due to the tearing that accompanies penetration, can result in a twelvefold increase in effective surface energy. Nonbasal cleavage is associated with a twinning mechanism, and an even higher surface energy is required to propagate a crack into a crystal oriented for this type of cleavage. The results carry the implication that, in the absence of surface defects, fatigue failure in polycrystalline zinc is nucleated at the first internal grain boundary and not at the surface.

2876 Analytic embedded atom method model for bcc metals. Johnson, R.A. (Materials Science Department, University of

Virginia, Charlottesville, Virginia 22901 (US)); Oh, D.J. *Journal of Materials Research (USA),* 4(5): 1195-1201 (Sep 1989).

The requirements for fitting bcc metals within the EAM format are discussed and, for comparative purposes, the EAM format is cast in a normalized form. A general embedding function is defined and an analytic first- and second-neighbor model is presented. The parameters in the model are determined from the cohesive energy, the equilibrium lattice constant, the three elastic constants, and the unrelaxed vacancy formation energy. Increasing the elastic constants, increasing the elastic anisotropy ratio, and decreasing the unrelaxed vacancy formation energy favor stability of a close-packed lattice over bcc. A stable bcc lattice relative to close packing is found for nine bcc metals, but this scheme cannot generate a model for Cr because the elastic constants of Cr require a negative curvature of the embedding function.

2877 **Theoretical study of noble-metal (100) surface reconstructions using first-principles techniques.** Takeuchi, N. (Ames Laboratory-U.S. Department of Energy, and Department of Physics, Iowa State University, Ames, Iowa 50011 (US)); Chan, C.T.; Ho, K.M. *Physical Review Letters (USA),* 63(12): 1273-1276 (18 Sep 1989). DOE Contract W-7405-ENG-82.

Using first-principles calculations, in conjunction with modeling techniques, we show that the top layer of the Au(100) surface will transform to a close-packed structure while that of Ag(100) will not. Our calculations provide some insight into the microscopic origin of the difference in stability between 4*d* and 5*d* fcc metal (100) surfaces.

2878 **Laser-induced interface reactions of copper thin films on sapphire substrates.** Godbole, M.J. (Department of Materials Science and Engineering, The University of Tennessee, Knoxville, Tennessee 37996-2200 (US)); Pedraza, A.J.; Lowndes, D.H.; Kenik, E.A. *Journal of Materials Research (USA),* 4(5): 1202-1208 (Sep 1989). DOE Contract AC05-84OR21400.

The interface of a copper-sapphire couple that was irradiated with a nanosecond pulsed-excimer laser was studied by transmission electron microscopy. Deposited layers of 30 or 100 nm thickness were laser treated with energy densities in the range of 0.5 to 0.75 J/cm^2. Two different atmospheres were used during these treatments, viz., air or a mixture of argon-4 vol.% hydrogen. The copper film and a thin alumina layer were melted by the laser pulse. Two well differentiated regions could be observed in the modified layer. The region closer to the unmodified substrate consisted of epitaxially regrown alumina with crystallites misoriented up to 10° relative to the substrate sapphire orientation, while precipitate particles could be seen closer to the resolidified copper. The nature of the precipitates generated in the second region was dependent on the atmosphere present during the treatment. In air a trirutile-like compound was obtained which is either oxygen or copper deficient. In an argon atmosphere a compound having a hexagonal structure closely related to sapphire was observed, where copper substituted for some aluminum. These observations are in agreement with a previously developed mathematical model that predicts melting of a thin substrate layer.

2879 **Optical second harmonic generation from Ni(110) with adsorbed CO.** Hamilton, J.C. (Sandia National Laboratories, Livermore, California 94551-0969 (US)); Anderson, R.J.M.; Williams, L.R. *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena (USA),* 7(5): 1208-1211 (Sep 1989).

Optical second harmonic intensity from Ni(110) has been measured as a function of CO exposure, temperature, and excitation wavelength and compared with similar experiments on Ni(111). Second harmonic generation from Ni(110) is much weaker than from Ni(111); there is little or no azimuthal dependence of the second harmonic intensity; and the effect of CO on the second harmonic intensity is much less than for Ni(111). These observations are explained in terms of the unoccupied electronic levels of the two surfaces.

2880 **Comment on "Self-similarity of diffusion-limited aggregates and electrodeposition clusters".** Li, G. (Department of Physics, University of Michigan, Ann Arbor, Michigan 48109-1120 (US)); Sander, L.M.; Meakin, P. *Physical Review Letters (USA),* 63(12): 1322 (18 Sep 1989).

A Comment on the Letter by F. Argoul *et al.*, Phys. Rev. Lett. 61, 2558 (1989).

2881 **Anomalous local hopping of Sn impurities in lead.** Shechter, H. (Department of Physics and Solid State Institute, Technion, Haifa, Israel (IL)); Stern, E.A.; Yacoby, Y.; Brener, R.; Zhang, Z. *Physical Review Letters (USA),* 63(13): 1400-1403 (25 Sep 1989).

The Moessbauer spectral intensity of ^{119}Sn impurities in Pb with concentration of 5%, 2%, 1%, and 1/2% is measured as a function of temperature. A single narrow line is observed which slightly narrows as the temperature increases. Above a temperature $T_c \ll T_m$, the bulk melting temperature, the Moessbauer integrated intensity drops precipitously from a Debye-Waller behavior. Analysis of the results shows that a small region around each Sn atom is in a state of relatively large entropy, suggesting a local behavior more similar to a liquid than a solid.

2882 **Thermally and ion-induced phase formation in a Pd/Ge bilayer.** Li, J. (Department of Materials Science and Engineering, Cornell University, Ithaca, New York 14853 (US)); Hong, Q.Z.; Mayer, J.W. *Journal of Applied Physics (USA),* 66(8): 3600-3603 (15 Oct 1989).

Pd/Ge bilayer samples with three different overall compositions centered around Pd_2Ge have been thermally annealed or irradiated with 300 keV Kr ions at room temperature. We observed that the first phase formed with ion irradiation, as in thermal annealing is Pd_2Ge. In the $Pd_{75}Ge_{25}$ sample, the formation of an amorphous phase as well as the Pd_2Ge phase has been observed after 3×10^{15} Kr$^+$/cm^2 irradiation. Successive irradiations up to the 5×10^{15} Kr$^+$/cm^2 led to the demixing of this amorphous phase to Pd_2Ge and Pd.

2883 **Thermodynamic properties of fcc transition metals as calculated with the embedded-atom method.** Foiles, S.M. (Theoretical Division, Sandia National Laboratories, Livermore, California 94551 (US)); Adams, J.B. *Physical Review [Section] B: Condensed Matter (USA),* 39(9): 5909-5915 (15 Sep 1989).

Solid and liquid Gibbs free energies of Cu, Ag, Au, Ni, Pd, and Pt have been calculated through the use of the embedded-atom method, and the results are in good agreement with experiment. The melting points of the materials are calculated from the intersection of the solid and liquid free-energy curves. The values of the melting point are in excellent agreement for the noble metals and in reasonable agreement for Ni, Pd, and Pt. The thermal expansions of the solids are computed and the results are in excellent agreement with experiment over the entire temperature range.

2884 **Lattice dynamics of quenched diffuse ω phase in $Zr_{0.8}Nb_{0.2}$.** Noda, Y. (Faculty of Engineering Science, Osaka University, Toyonaka, Osaka 560, Japan (JP)); Yamada, Y.; Shapiro, S.M. *Physical Review [Section] B: Condensed Matter (USA),* 39(9): 5995-6002 (15 Sep 1989).

Phonon dispersion curves of the quenched diffuse ω phase of $Zr_{0.8}Nb_{0.2}$ have been measured along the [100], [001], [111], and [211] directions. Special attention was paid to the transverse-acoustic (TA) mode along the [211] and [011] directions in order to understand the structural and dynamical characteristics of the diffuse ω phase. In addition to the ordinary phonon branches, extra excitations forming subsidiary branches were observed for those TA modes, one of which had already been reported by Axe *et al.* In order to explain such anomalous behavior, we discuss the result in terms of the modulated lattice-relaxation model and the heterogeneous two-phase model.

2885 **Empirical electron-phonon coupling constants and anisotropic electrical resistivity in hcp metals.** Sanborn, B.A. (Department of Physics, State University of New York, Stony Brook, New York 11794-3800 (US)); Allen, P.B.; Papaconstantopoulos, D.A. *Physical Review [Section] B: Condensed Matter (USA),* 39(9): 6037-6044 (15 Sep 1989).

The Fermi-surface density of states $N(0)$ and Drude-plasma-frequency tensor $(\Omega_p{}^2)_{\alpha\beta} = 4\pi e^2 N(0)\langle v_\alpha v_\beta\rangle$ are calculated for 14 metallic elements with hcp structures. By comparison with measured anisotropic resistivity components $\rho_\perp$ and $\rho_\parallel$, electron-phonon coupling constants are extracted. The resulting values of λ_{tr} compare reasonably well with λ from T_c for the ten superconducting

elements and provide new information on electron-phonon coupling for the four that are not. In particular, λ_{tr} for Mg is sufficiently low as to discourage a further search for superconductivity, whereas λ_{tr} for Sc and Y is sufficiently high (0.5–0.6) to require spin-fluctuation suppression of T_c and motivate a low-T search for exotic superconductivity. Co is found to have very weak electron-phonon coupling in the majority-spin band and much stronger specific-heat enhancement in the minority-spin band. The anisotropy $\rho_{zz}/\rho_{xx}=\rho_{\parallel}/\rho_{\perp}$ is moderately well accounted for by the anisotropy of the Drude plasma frequency $(\Omega_p^2)_{xx}/(\Omega_p^2)_{zz}=\langle v_x^2\rangle/\langle v_z^2\rangle$, except for the *sp* elements, which have significant scattering anisotropy ($\lambda_{zz}/\lambda_{xx}\neq 1$). A systematic onset of "resistivity saturation" (signifying a breakdown of Boltzmann theory) is found when the mean free path $l\lesssim 10$ A. The onset occurs at a variable value $40<\rho<160$ $\mu\Omega$ cm.

2886 Detection of Alpher-Rubin attenuation and a search for nuclear acoustic resonance of surface waves in tantalum films. Spulak, R.G. Jr. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)). *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6052-6057 (15 Sep 1989). DOE Contract AC04-76DP00789.

The first observation of Alpher-Rubin attenuation of surface acoustic waves is reported. The surface waves were propagated on an *ST*-cut quartz substrate, and absorption occurred in a 10-μm tantalum film due to the surface-wave-driven oscillation of conduction electrons in an external 24-kG magnetic field. A scaling law is derived that relates attenuation coefficients of bulk and surface waves. Unsuccessful searches were made for nuclear acoustic resonance (NAR) of surface waves due to electric quadrupole transitions of ^{181}Ta and magnetic dipole transitions of ^{1}H. Theoretical estimates of the attenuation of surface waves agree with the observed Alpher-Rubin effect and indicate that the NAR signal was less than the noise.

2887 Structural properties of liquid alkali-metal–lead alloys: NaPb, KPb, RbPb, and CsPb. Reijers, H.T.J. (Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439 (US)); Saboungi, M.; Price, D.L.; Richardson, J.W. Jr.; Volin, K.J.; van der Lugt, W. *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6018-6029 (15 Sep 1989). DOE Contract W-31-109-ENG-38.

The structural properties of liquid equiatomic alkali-metal–lead alloys *A*Pb, with *A*=Na, K, Rb, and Cs, have been studied with neutron diffraction. The experimental data are reduced to the neutron-weighted total structure factors $S(Q)$ and radial distribution functions $n(r)$. In all the systems studied, $S(Q)$ is characterized by a first sharp diffraction peak (FSDP) at $Q\sim 1$ A^{-1} and $n(r)$ by structure in the first coordination shell at $r\approx 3$–4 A, both features indicating the presence of polyatomic structural units. Two types of structural models have been fitted to the experimental data, both based on consideration of such units: the random packing of structural units model, and the reference interaction site model. The structures of the units are derived from powder-diffraction measurements made with the same instrument on solid polycrystalline samples. Allowing for a slight expansion of the units on melting and using physically reasonable values for the adjustable parameters, both models give satisfactory agreement with the experimental data and are used to give the partial structure factors and pair distribution functions. Inelastic-scattering measurements have been made on one system, liquid KPb, using a spectrometer at the same source. These yield a value for the mean diffusion constant, $D=1.2\pm0.2\times10^{-5}$ cm^2/sec, and a smoothly varying inelastic scattering spectrum with no indication of excitations of a molecular character. The FSDP remains well defined when the inelastic scattering is integrated over small energy transfers, indicating a lifetime of 10^{-13} sec or longer for the intermediate-range order responsible for this peak.

2888 Anharmonic damping in rare-gas multilayers. Hall, B. (Department of Physics and The Institute for Surface and Interface Science, University of California, Irvine, Irvine, California 92717 (US)); Mills, D.L.; Zeppenfeld, P.; Kern, K.; Becher, U.; Comsa, G. *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6326-6338 (15 Sep 1989).

We have calculated the linewidths from anharmonic damping, for the phonon modes of rare-gas bilayers and trilayers adsorbed on the Pt(111) surface. This is done through use of perturbation theory, which in lowest order provides no damping for the monolayer vibration polarized normal to the surface. We also assume that the source of anharmonicity is the lateral interactions between adsorbates. We find linewidths in the range 0.1–0.2 meV at the temperature $T\approx 25$ K for all cases studied, save for the Ar bilayer, which is found to be more heavily damped. The results, supplemented by inclusion of radiative damping produced by coupling to substrate phonons, are compared with new experimental results for both the linewidth and dispersion of the normal modes of Ar, Kr, and Xe monolayers, bilayers, and trilayers adsorbed on the Pt(111) surface. The theoretical and experimental results are in good accord.

2889 First-principles total-energy calculations on Y and α-$YH_{0.5}$. Min, B.J. (Ames Laboratory, U. S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011 (US)); Ho, K. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7532-7536 (15 Oct 1989). DOE Contract W-7405-ENG-82.

First-principles total-energy calculations have been performed for yttrium in the bcc, fcc, and hcp structures. The density of states at the Fermi energy, cohesive energy, equilibrium lattice constant, and bulk modulus of the ground-state hcp structure are obtained and compared with experimental results. Calculations are also carried out to investigate the lattice expansion and c/a ratio change with the addition of hydrogen.

2890 Distance of the image plane from metal surfaces. Smith, N.V. (AT&T Bell Laboratories, Murray Hill, New Jersey 07974 (US)); Chen, C.T.; Weinert, M. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7565-7573 (15 Oct 1989). DOE Contract AC02-76CH00016.

The data base of surface-state energies on the metals Cu, Ag, Au, Ni, Pd, and Pt is assembled and, with the aid of a simple model, is used to estimate the distance of the image plane and its trends from surface to surface and metal to metal. The model combines a nearly-free-electron representation of the crystal with a Jones-Jennings-Jepsen ansatz for the saturated image barrier. The projected bulk-band gaps are taken from published determinations. Constraints are placed on the surface barrier parameters by appeal to the results of self-consistent first-principles slab calculations. The general experimental trend observed is for the image-plane distance z_0 to decrease in the sequence (111) to (001) to (110), in the same sense but not as rapidly as z_J, the distance of the effective jellium edge. This trend is rationalized using a simple model of the tail of the surface charge density. Typical values for z_0-z_J fall in the range -0.2 to $+0.5$ a.u., with the larger values occurring for the 3*d* metals Cu and Ni.

2891 Photoemission study of formation and oxidation of a cerium-copper interface. Braaten, N.A. (University of Trondheim, Norges Tekniske Hogskole, N-7034 Trondheim, Norway (NO)); Grepstad, J.K.; Raaen, S. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7969-7972 (15 Oct 1989).

Deposition of Ce on a polycrystalline Cu film has been studied by x-ray photoelectron spectroscopy and ultraviolet photoelectron spectroscopy with use of synchrotron radiation. The formation of a relatively thick interface, >100 A, is observed at room temperature. The interface is found to contain about 80 at. % Ce and cannot be accounted for in terms of formation of an intermetallic compound based on the Ce-Cu phase diagram. A conversion from trivalent to tetravalent Ce ions is observed for a thin Ce-Cu interface when exposed to oxygen. The Cu substrate is not oxidized appreciably for oxygen exposures up to 1000 langmuir.

2892 Electronic origin of the intermediate phase of NiTi. Zhao, G. (Ames Laboratory-U.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011 (US)); Leung, T.C.; Harmon, B.N.; Keil, M.; Mullner, M.; Weber, W. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7999-8001 (15 Oct 1989).

A nesting feature in the Fermi surface of ordered, equiatomic NiTi is reported, and related to observed "premartensitic" phenomena.

2893 Scanning tunneling microscopy of orthorhombic TaS_3. Slough, C.G. (Department of Physics, University of Virginia,

Charlottesville, Virginia 22901 (US)); Coleman, R.V. *Physical Review [Section] B: Condensed Matter (USA),* 40(11): 8042-8044 (15 Oct 1989).

Scanning-tunneling-microscopy studies of orthorhombic TaS_3 at 77 K show a charge-density modulation of wavelength $4c_0$ strongly localized on two separate pairs of chains. The charge maxima are out of phase and suggest a strong coupling between the two charge modulations.

2894 **Patterson analysis of aperiodic crystals.** Ma, Y. (Department of Physics, University of Washington, Seattle, Washington 98195 (US)); Stern, E.A.; Li, X.; Janot, C. *Physical Review [Section] B: Condensed Matter (USA),* 40(11): 8053-8056 (15 Oct 1989).

Aspects of the Patterson-function (PF) analysis of the structure of aperiodic crystals are studied experimentally on icosahedral Al-Mn-Si and by computer simulation. In the icosahedral Al-Mn-Si system, a PF analysis using only the experimentally distinguishable peaks and neglecting the remaining background changes the two Mn-Mn distances of 4.6 and 5.0 A to a single 4.8 A distance. Computer simulations on one-dimensional (1D) and 2D models of aperiodic structures show that neglect of background in the PF analysis distorts disordered structures toward the quasicrystalline model, indicating that care should be exercised in drawing conclusions from the analysis of diffraction data.

2895 **Phonon dispersion measurements and first-principles calculations for the Au(110) surface.** Voigtlander, B. (Institut fur Grenzflachenforschung und Vakuumphysik, Kernforschungsanlage Julich GmbH, Postfach 1913, 5170 Julich, Federal Repubic of Germany (DE)); Lehwald, S.; Ibach, H.; Bohnen, K.P.; Ho, K.M. *Physical Review [Section] B: Condensed Matter (USA),* 40(11): 8068-8071 (15 Oct 1989).

We have measured the dispersion of surface phonons on the (1×2) reconstructed Au(110) surface along the high-symmetry directions using momentum resolved electron-energy-loss spectroscopy. The frequencies of surface modes at high-symmetry points of the surface Brillouin zone have been calculated with force constants determined from first-principles self-consistent total-energy calculations and are in excellent agreement with the experimental data. "Glue-model" calculations which predicted an experimentally not observed dipole active mode peeling off the top of the bulk phonon band seem to overestimate the bonding strength of atoms near the surface.

2896 **Chromium modified nickel-iron aluminide useful in sulfur bearing environments.** Cathcart, J.V.; Liu, C.T. To Dept. of Energy, Washington, DC. USA Patent 4,839,140. 13 Jun 1989. Filed date 31 Aug 1987. USA Patent Application 7,091,561. Int. Cl. C22C 19/05. 6p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an improved nickel-iron aluminide containing chromium and molybdenum additions to improve resistance to sulfur attack. The corrosive effects of sulfur are discussed and the chemical composition of corrosion resistant alloys is illustrated.

3602 Ceramics, Cermets, and Refractories

Refer also to citation(s) 2067, 2068, 2295, 2307, 2432, 2659, 2782, 2783, 2823, 2824, 2841, 2848, 2878, 2889, 2967, 3031, 3117, 3213, 3214, 3233, 4233, 4237, 4248, 4249, 4250, 4251, 4252, 4253, 4255, 4256, 4258, 4470

2897 (AD-A–210197/0/XAB) **Processing and fabrication of high-temperature oxide superconductors. Annual report, 1 August 1988-30 June 1989.** Johnson, S.M. SRI International, Menlo Park, CA (USA). 7 Jul 1989. 15p. Available from NTIS, PC A03/MF A01.

During the past year, the author has been optimizing a process for synthesizing superconductor powders by freeze-drying. His objectives are to develop an understanding of the processing of these powders and to fabricate simple shapes from freeze-dried powders. He has synthesized a series of powders from solutions of barium acetate, copper nitrate, and yttrium nitrate, with pH values of 2.8 to 9.8 and calcined at temperatures from 510 to 908C. He is determining the surface area of these powders by BET AND XRD. Selected powders are being characterized by SEM, DTA, ICP analysis (performed at Stanford University), carbon analysis, and tap density. The highest surface area (in lightly milled powders) of 4.4 sq m/g was achieved with a pH of 4 in a series of experiments in which the Ba and Y solutions were mixed together before the Cu nitrate solution was added, then calcined at 825C. Surface areas decrease with increasing calcining temperature, however. It appears that calcining at 750 or 850 C gives the best critical temperature, with complete transitions at greater than 90K. Critical-temperature measurements performed at Stanford show that the author has achieved his goal of a critical temperature of 90K and a temperature difference, W, between 10% and 90% of transition of <2K.

2898 (AD-A–210781/1/XAB) **Plasma-activated ion-beam reactive sputtering of NbN thin films.** Lichtenwalner, D.J.; Anderson, A.C.; Rudman, D.A. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 25 Nov 1988. 7p. (MS–8036). Available from NTIS, PC A02/MF A01.

Pub. in Materials Research Society Symposium Proceedings, Vol. 128, 67-72(1989).

In order to better study and control the processes occurring in a reactive sputtering situation, a unique deposition method was used in which the Ar-ion-beam sputtering of an elemental Nb target is combined with an auxillary Ar/N_2 plasma at the substrate. The ion source allows independent control of the sputtering parameters (ion flux, energy). The magnetically enhanced triode plasma provides a source of ionized and excited nitrogen at the film surface, and allows independent control of the substrate plasma parameters. A conductance-limiting enclosure surrounds the substrate, resulting in a pressure differential of nearly an order of magnitude between the substrate and target regions. This enables separation of the substrate and target-reaction regimes at low nitrogen flows. NbN was investigated because of its technological importance and the fact that it is representative of transition metal nitrides. With the substrate plasma off and N_2 provided at the substrate, the cubic superconducting NbN (delta phase) is produced even at low N_2 flows, when the target is in the unreacted, metallic state. Upon increasing the N_2 flow, the nitrogen content of the films abruptly increases as the target reaction proceeds. The addition of the substrate plasma results in the nonsuperconducting hexagonal delta phase, which to the authors knowledge has not previously been produced as a single-phase thin film. The electrical properties of the delta phase are reported.

2899 (AD-A–211070/8/XAB) **High-temperature ceramic superconductors. Annual technical report, 24 May 1988-30 June 1989.** Mazdiyasni, K.S. General Atomics, San Diego, CA (USA). 15 Jul 1989. 111p. (GA-A–19800). Available from NTIS, PC A06/MF A01.

The principal goals of this program are (1) to demonstrate fabrication of high-temperature ceramic superconductors via sol-gel methods that can operate at or above 90K with appropriate current density, in forms useful for application in resonant cavities, magnets, motors, sensors, computers, and other devices; and (2) to fabricate and demonstrate selected components made of these materials, including microwave cavities and magnetic shields. The chemical pathways for preparation of 123 powder, fiber, and film were identified.

2900 (AD-A–211249/8/XAB) **Continuous high-temperature lubrication of ceramics by carbon generated catalytically.** Lauer, J.L.; Dwyer, S.R. Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics. Jun 1989. 7p. Available from NTIS, PC A02/MF A01.

Pub. in Materials Research Society Symposium Proceedings, Vol. 140, 363-368(Jun 1989).

A system for the continuous lubrication of ceramic surfaces at high temperatures by a carbon formed exclusively at the wear surfaces is described. The lubricant is delivered as a simple gas, ethylene, which is catalytically transformed. No reaction products are left which contain bearing surface material and the only nonvolatile product is lubricating carbon. One of the wearing surfaces must contain or have an overlay of nickel (about 1000 A thick in this work) and, preferably, a coating of nickel oxide on top to reduce nickel wear during startup. Since the carbon is formed only on nickel and the oxide is worn only in the wear track, only the wear track is lubricated. The laboratory system consisted of a sapphire pin on a nickel-coated rotating alumina disc. Ethylene was delivered

only to the conjunction region, which was surrounded by air. Contact pressures were about 200 MPa, linear speeds between 3 and 9 cm/sec. Friction coefficients dropped from 0.6 to 0.06 when ethylene was delivered to the contact at 500 C. Wear rates were not measureable under operating conditions. Gases other than ethylene and catalysts other than nickel will be explored in further work.

2901 (AD-A-211281/1/XAB) **Acoustic studies of new materials: Quasi crystals, low-loss glasses, and high tc superconductors. Annual summary report, 1 October 1988-30 September 1989.** Maynard, J.D. Pennsylvania State Univ., University Park, PA (USA). Dept. of Physics. 1 Aug 1989. 19p. Available from NTIS, PC A03/MF A01.

The goals of this project involve the development and application of new techniques in acoustics. The goals are: (a) to study the properties of single-crystal high-temperature superconductor oxide materials with ultrasonic measurements; (b) to study the properties of quasi crystals using ultrasound and acoustic analog systems; and (c) to develop and apply a new resonant photoacoustic technique to measure optical absorption in very low-loss glasses and crystals. Major accomplishments include the development of a new method of ultrasound measurement which permits the determination of all of the independent elastic constants of very small samples (a few hundred microns in size), and the development and test of a new technique for measuring optical absorption with more than an order-of-magnitude improvement in sensitivity over existing methods.

2902 (ANL/PPRNT–89-189) **Creep of chromia and yttria-doped chromia.** Dominguez-Rodriguez, A.; Goretta, K.C.; King, W.E.; Park, J.-H.; Routbort, J.L. Argonne National Lab., IL (USA). Nov 1987. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90003006. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Compressive creep tests of pure and Y-doped Cr_2O_3 at 1217°C have shown that the presence of Y increases diffusional flow rates substantially. It is inferred that this increase in deformation rate may account, in part, for the empirical fact that Y-containing scales adhere better to the underlying metal than pure scales do. 10 refs., 1 fig.

2903 (BNL–42550-Rev.) **Glancing angle x-ray studies of oxide films: Revision.** Davenport, A.J.; Isaacs, H.S. Brookhaven National Lab., Upton, NY (USA). 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016;AS05-80ER10742. (CONF-890960–1-Rev.: 6. international symposium on passivity: passivation of metals and semiconductors, Sapporo (Japan), 24-28 Sep 1989). Order Number DE90003261. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

High brightness synchrotron radiation incident at glancing angles has been used to study inhibiting species present in low concentrations in oxide films on aluminum. Glancing incident angle fluorescence measurements give surface-sensitive information on the valence state of elements from the shape of the x-ray absorption edge. Angle-resolved measurements show the depth distribution of the species present. 15 refs., 4 figs.

2904 (BNL–43373) **Phase separation of holes in antiferromagnets.** Emery, V.J.; Kivelson, S.A.; Lin, H.Q. Brookhaven National Lab., Upton, NY (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research; National Aeronautics and Space Administration; National Science Foundation. DOE Contract AC02-76CH00016. (CONF-890953–11: International conference on the physics of highly correlated electron systems, Santa Fe, NM (USA), 11-15 Sep 1989). Order Number DE90003255. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

It is shown that dilute holes in an antiferromagnet are unstable against phase separation into a hole-rich phase and a no-hole phase. When the spin exchange interaction J exceeds a critical value J_c, one phase consists of all holes, the other all electrons. The argument is presented in detail for the t–J model but evidence of phase separation in other models is mentioned. 11 refs.

2905 (CONF-890480–2) **Local atomic displacements in high T_c oxides studied by pulsed neutron scattering.** Egami, T.; Toby, B.H.; Dmowski, W.; Jorgensen, J.D.; Hinks, D.; Subramanian, M.A.; Gopalakrishnan, J.; Sleight, A.W.; Parise, J.B. Argonne National Lab., IL (USA). Jun 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Conference on oxygen disorder effects in high T_c superconductors; Trieste (Italy); 18-21 Apr 1989. Order Number DE90002217. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Various deviations from perfect periodicity in the atomic structure are found in real superconducting oxides, due to extrinsic defects such as oxygen vacancies, site occupation disorder, or twins. However, there are strong indications that these oxides also contain significant intrinsic disorder which may play a role in the superconductivity. A common indication of such disorder is a large "temperature factor", or the Debye-Waller factor, in the atomic structure which is often hardly dependent on temperature. By using the method of atomic pair distribution function (PDF) analysis of pulsed neutron powder diffraction data, we found in some oxides these large thermal factors are in fact due to local atomic displacements with only short range order. All elastic scattering intensities, including both the Bragg diffraction diffuse scattering intensities, are utilized in deriving the distribution of the atomic distances, or the PDF. Thus it is an ideal method to study a structure with short range order. We describe some of the results obtained by this method and discuss the effect of such a short range order on the superconductivity. 21 refs., 4 figs.

2906 (CONF-891036–2) **Solid lubrication of ceramic sufraces by IAD [ion-assisted deposition]-silver coatings for heat engine applications.** Erdemir, A.; Fenske, G.R.; Nichols, F.A.; Erck, R.A. Argonne National Lab., IL (USA). 1989. 31p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Joint American Society of Mechanical Engineers/Society of Tribologists and Lubrication Engineers tribology conference; Ft. Lauderdale, FL (USA); 16-19 Oct 1989. Order Number DE90002860. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this study, an investigation was made of the tribological characteristics of alumina ceramics coated with silver by means of ion-assisted deposition (IAD). Tests were performed at temperatures up to 400°C on an oscillating-slider wear test machine capable of simulating the reciprocating motion of a ring/cylinder system. The results showed that higher test temperatures caused greater wear damage and increased friction for uncoated alumina. At 400°C, the wear rates of the alumina-alumina test pairs were 8 to 10 times higher than those tested at room temperature. The steady-state friction coefficients were also fairly high, typically ranging from 0.8 to 1.1. In contrast, the wear rate of IAD-silver coated flats was virtually zero and the wear rates of the counterface pins were reduced by a factor of 72. Friction was also reduced to about half to one third of those for the uncoated pairs. Surface and structure analytical investigations together with the hot-hardness testing of substrate alumina at temperatures up to 600°C were performed to ascertain the mechanisms responsible for the friction and wear behavior of both alumina-alumina and alumina-IAD-silver coated alumina pairs. 28 refs., 8 figs.

2907 (CONF-891119–4) **The effects of annealing on the structure and distribution of charge states of iron implanted into α-Al_2O_3 at 77 K.** McHargue, C.J.; Sklad, P.S.; McCallum, J.C.; White, C.W.; Perez, A.; Marest, G. Oak Ridge National Lab., TN (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90002929. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Implantation of iron into α-Al_2O_3 at 77 K produces an amorphous state for fluences greater than about 3×10^{16} Fe/cm^2. Iron in the as-implanted (amorphous) specimens is distributed among two Fe^{2+}, two Fe^{4+}, and the Fe^0 states. The conversion electron Moessbauer (CEMS) spectra for a sample containing 7×10^{16} Fe/cm^2 show all iron to be converted to Fe^{3+} after annealing in oxygen for 1 h at 700°C and above. The transmission electron microscopy (TEM) shows the structure to be mostly Y-Al_2O_3 after the 900°C anneal and all α-Al_2O_3 after the 1100°C anneal. 5 refs., 4 figs., 1 tab.

2908 (CONF-891119–6) **Structure of amorphous Al_2O_3 produced by ion implantation.** McHargue, C.J.; Sklad, P.S.; Angelini, P.; White, C.W.; McCallum, J.C.; Perez, A.; Marest, G. Oak

Ridge National Lab., TN (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003065. Available from NTIS, PC A02/MF A01; OSTI; INIS.

The amorphous state can be produced in α-Al_2O_3 by ion beam induced displacements at 77 K or by displacements combined with chemical effects at room temperature. Progress toward understanding the amorphization process has been made from studies of the short-range order, electronic charge on implanted species, and the critical composition for amorphization. Results are presented for implantation of Al + O in the stoichiometric ratio, zirconium, iron, and tin. 10 refs., 6 figs.

2909 (CONF-8906119–4) **The effect of composition and processing on high T_c superconductors containing bismuth.** Nash, A.S.; Goretta, K.C.; Poeppel, R.B. Argonne National Lab., IL (USA). Jun 1989. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Powder metallurgy conference; San Diego, CA (USA); 11-14 Jun 1989. Order Number DE90002203. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effect of doping and fabrication parameters on the transition temperature and structure of high-T_c Bi-Sr-Ca-Cu oxide superconducting compounds doped with silver and SnO_2 were studied. It was found that SnO_2 lowers the melting point of 4336 producing single-phase high-T_c superconductor at low levels of doping and firing temperatures, 750–825°C. The semiconducting behavior observed in samples fired at higher temperatures is attributed to the loss of oxygen in copper-oxide sheets. The effect of level of doping and firing temperature on T_c and structure of Bi-based superconductors beyond the range discussed in this paper are under further investigation.

2910 (CONF-8908133–7) **Nature of phonons, isotope effect, and superconductivity in $Ba_{1-x}K_xBiO_3$.** Degani, M.H.; Kalia, R.K.; Vashishta, P. Argonne National Lab., IL (USA). Oct 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 24. Yamada conference on strongly coupled plasma physics; Tokyo (Japan); 29 Aug - 2 sep 1989. Order Number DE90002778. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Phonon density-of-states of insulating $BaBiO_3$ in orthorhombic phase and superconducting $Ba_{0.6}K_{0.4}BiO_3$ in cubic phase are studied using the molecular dynamics (MD) method. The MD results are compared with the recent inelastic neutron scattering experiments and electron tunneling experiments. The exponent of the oxygen isotope effect is calculated from the first moment of the phonon density of states (the weak coupling limit) and from the solution of Eliashberg gap equations. Results are compared with isotope effect experiments. Evidence based on inelastic neutron scattering, tunneling, and isotope effect experiments when combined with the MD calculations suggest that this material is a normal weak coupling BCS superconductor with strong coupling of the carriers to the high energy oxygen phonons. 14 refs., 6 figs., 3 tabs.

2911 (CONF-8910120–1) **High-temperature corrosion of heat exchanger materials.** Federer, J.I. Oak Ridge National Lab., TN (USA). 1989. 29p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 1. international ceramic science and technology congress; Anaheim, CA (USA); 31 Oct - 3 nov 1989. Order Number DE90001963. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Silicon-based and oxide ceramics are candidate matrix materials for ceramic composites for heat exchanger tubes and other critical applications. The corrosion behavior of matrix materials was investigated by exposure tests in industrial furnaces, and composites containing the most corrosion-resistant matrix materials were tested in laboratory furnaces. SiC and Si_3N_4 ceramics corroded severely in industrial furnace atmospheres containing alkali compounds. Oxide ceramics, such as Al_2O_3 and ZrO_2, corroded relatively little in the same atmospheres, but their corrosion increased with increasing SiO_2 content. Most ceramic composites containing hoop-wrapped continuous fiber in Al_2O_3 and stabilized ZrO_2 matrices exhibited dimensional instability during a laboratory corrosion test, but composites containing helical-wrapped fiber were stable. 6 refs., 12 figs., 3 tabs.

2912 (CONF-8910120–3) **Effect of gaseous corrosion on the strength of SiC and Si_3N_4.** Kim, Hyoun-Ee; Moorhead, A.J. Oak Ridge National Lab., TN (USA). [1989]. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 1. international ceramic science and technology congress; Anaheim, CA (USA); 31 Oct - 3 nov 1989. Order Number DE90002706. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effects of gaseous corrosion on the room-temperature flexural strength of SiC and Si_3N_4 were investigated. Sintered α-SiC and hot-pressed Si_3N_4 were exposed to flowing H_2 or Ar at 1400°C for 10 h. The explored variables, water vapor pressure in the H_2 or oxygen partial pressure in the Ar, were found to significantly affect the corrosion of these materials. Reductions in room-temperature strength were observed when weight loss resulted from active oxidation, except for the Si_3N_4 exposed in Ar containing O_2. Large pits that formed during exposure were responsible for the strength reductions. When the P_{H_2O} in H_2 or P_{O_2} in Ar was high enough to form a thin oxide layer on the sample surface, the observed strength increased, ultimately to values greater than that of the as-polished material. However, under conditions in which a much thicker oxide layer was formed, the strengths were unaffected or decreased slightly, the latter being attributed to the generation of new flaws such as bubbles or cracks in the oxide layer. 34 refs., 8 figs.

2913 (CONF-8910248–1) **Numerical and empirical verification of the stress state in a ceramic, button-head, tensile specimen.** Jenkins, M.G.; Ferber, M.K.; Martin, R.L.; Poteat, R.M.; Tennery, V.J. Oak Ridge National Lab., TN (USA). [1989]. 34p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Annual automotive technology development contractors coordination meeting; Dearborn, MI (USA); 23-26 Oct 1989. Order Number DE90001645. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Characterization of the mechanical properties of ceramics in uniform, uniaxial stress fields is of paramount importance to the successful implementation of sophisticated life prediction methodologies proposed for use in advanced ceramic designs. Recent increases in the use of tensile tests for structural ceramics, coupled with increasing ultimate strengths in these materials have revealed anomalies in the locations and circumstances of failures in the commonly-used button-head, tensile specimen (e.g., non-gage section fractures especially in the button-head area). The objective of this study was to numerically and empirically verify the stress-state in the ceramic, button-head tensile specimen as tested in conjunction with hydraulic couplers in the load train which have been reported to consistently hold bending strain errors to less than 1% at specimen failure. 6 refs., 4 figs.

2914 (CONF-8910273–1) **Anisotropy of oxygen tracer diffusion in $YBa_2Cu_3O_{7-\delta}$ single crystals.** Rothman, S.J.; Routbort, J.L.; Liu, J.-Z.; Downey, J.W.; Thompson, L.J.; Fang, Y.; Shi, D.; Baker, J.E.; Rice, J.P.; Ginsberg, D.M. Argonne National Lab., IL (USA). Sep 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium on atomic migration and defects in materials; Indianapolis, IN (USA); 1-5 Oct 1989. Order Number DE90001931. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The crystal structure of $YBa_2Cu_3O_{7-\delta}$ strongly suggests that the diffusion of oxygen in this material will be highly anisotropic, with diffusion in the ab plane being much faster than diffusion parallel to the c axis, and this has been assumed in most analyses of diffusion in $YBa_2Cu_3O_{7-\delta}$. The present data confirm this hypothesis; the diffusion coefficient in the ab plane is several orders of magnitude greater than the diffusion coefficient along the c axis. Some interesting artifacts of the measurement, due to this strong anisotropy, are also revealed. Oxygen exchange in polycrystalline samples of $YBa_2Cu_3O_{7-\delta}$ is discussed in terms of these results. 15 refs., 9 figs.

2915 (EGG-M–89119) **Process monitoring using optical ultrasonic wave detection.** Telschow, K.L.; Walter, J.B.; Garcia, G.V.; Kunerth, D.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989.

7p. Sponsored by U.S. DOE Nuclear Energy; U.S. Department of the Interior. DOE Contract AC07-76ID01570. (CONF-890770--2: Conference on review of progress in quantitative NDE, Brunswick, ME (USA), 23-28 Jul 1989). Order Number DE90002021. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Optical ultrasonic wave detection techniques are being developed for process monitoring. An important limitation on optical techniques is that the material surface, in materials processing applications, is usually not a specular reflector and in many cases is totally diffusely reflecting. This severely degrades the light collected by the detection optics, greatly reducing the intensity and randomly scattering the phase of the reflected light. A confocal Fabry-Perot interferometer, which is sensitive to the Doppler frequency shift resulting from the surface motion and not to the phase of the collected light, is well suited to detecting ultrasonic waves in diffusely reflecting materials. This paper describes the application of this detector to the real-time monitoring of the sintering of ceramic materials. 8 refs., 5 figs.

2916 (EGG-M--89153) **Dissipation measurement in high T_c superconductors with electromagnetic probes.** Telschow, K.L.; O'Brien, T.K. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-890770--5: Conference on review of progress in quantitative NDE, Brunswick, ME (USA), 23-28 Jul 1989). Order Number DE90002058. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The new ceramic superconducting materials, which have transition temperatures above that of liquid nitrogen, have great potential. However, most fabrication schemes produce consolidated forms with relatively low critical currents; successful application of these materials requires a means of measuring their critical parameters (such as critical current) that can be used to monitor and control fabrication processes. This paper describes a technique for measuring the onset of dissipation in a superconducting coating in a local and noncontacting manner. This work begins the process of developing noncontacting techniques for the measurement of critical currents on a local scale with the capability of providing spatial information. 6 refs., 6 figs.

2917 (GAMI--90003256) **A global assessment of the business impacts of high transition temperature superconducting ceramic materials on permanent magnet producers, users, and raw materials suppliers 1987--2002.** Gorham Advanced Materials Inst., ME (USA). [1989]. 52p. Available from Gorham Advanced Materials Institute, P.O. Box 250, Gorham, Maine 04038.

This report is a global assessment of the business implications of ceramic high temperature superconductors on materials suppliers, producers, and users. (JEF)

2918 (IC--89/147) **Studies of the effect of age on the structure of polycrystalline ReO_3.** Majid, C.A. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 7p. Order Number DE90608043. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Structural studies of polycrystalline $H_{0.57}$ ReO_3 grown with age of ReO_3 placed in air for 2 1/2 years, at normal room temperature conditions, are reported. 13 refs, 1 tab.

2919 (INIS-mf--12020) **Studies of the ternary phase diagram U-Pu-O between 1000 and 2000deg C. Structural and physico-chemical properties of $Pu_xU_yO_z$ mixed oxides with a view to applications as fuel.** Theissig, W.; Hellmann, H.; Hoffmann, G.; Feulner, H. Muenchen Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Dec 1987. 20p. (In German). Contract BMFT 02 U 5454. Order Number DE90722241. Available from NTIS (US Sales Only), PC A03/MF A01.

The employment of a high-temperature-diffractometer and of other high-temperature-equipment for the studies of the U-Pu-O system is described. The available equipment was found to be unsuitable for the purpose of this particular project. (orig.) With 11 refs., 2 tabs., 10 figs.

2920 (JAERI-M--89-094) **1MeV-electron irradiation induced defects in epitaxially grown 3C-SiC.** Itoh, Hisayoshi; Hayakawa, Naohiro; Nashiyama, Isamu; Sakuma, Eiichiro. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 16p. Order Number DE90719574. Available from NTIS (US Sales Only), PC A03/MF A01.

Electron spin resonance (ESR) measurements have been performed for 1MeV-electron irradiated 3C-SiC crystals epitaxially grown by chemical vapor deposition method. The results indicate the presence of at least four paramagnetic defects (T1-T4 centers). The T1 center was found to consist of isotropic five lines equally spaced at about 1.5 G and to have a g-value of 2.0029+-0.0001. The anisotropic T2 center could be detected below about 100 K. The T3 and T4 centers were both anisotropic at room temperature. Isochronal annealing of electron irradiated 3C-SiC showed that the T1 center was annealed at three stages (150degC, 350degC, and 750degC) and that the T3 and T4 centers were annealed at 100degC and at 350degC respectively. (author).

2921 (LA-UR--89-3616) **Microwave characterization of high-temperature superconductors.** Cooke, D.W.; Gray, E.R.; Arendt, P.N.; Beery, J.G.; Bennett, B.L.; Brown, D.R.; Houlton, R.J.; Jahan, M.S.; Klapetzky, A.J.; Maez, M.A.; Raistrick, I.D.; Reeves, G.A.; Rusnak, B. Los Alamos National Lab., NM (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891090--1: Conference on monitoring and control of plasma-enhanced processing and multichamber growth of semiconductors, Santa Clara, CA (USA), 8-13 Oct 1989). Order Number DE90002408. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Thick (10-15 μm) Tl-Ba-Ca-Cu-O films have been deposited onto yttria-stabilized zirconia and Ag substrates by d.c. magnetron sputtering techniques. Direct deposition onto 1" diameter yttria-stabilized zirconia yields films with typical 22 GHz surface resistance (R_s) values of 5.2 $\pm$ 2 mΩ and 52 $\pm$ 2 mΩ at 10 K and 77 K, respectively. For comparison, R_s of Cu at this same frequency is 10 mΩ at 4 K and 22 mΩ at 77 K. Tl-Ba-Ca-Cu-O films have also been deposited onto 1" diameter Ag substrates using Au/Cu, Cu, and BaF_2 buffer layers. The lowest R_s values were obtained on films with a BaF_2 buffer layer, typical values being 7.8 $\pm$ 2 mΩ and 30.6 $\pm$ 2 mΩ (measured at 22 GHz) at 10 K and 77 K, respectively. Larger films (1.5" diameter) with similar R_s values were prepared using this same technique, demonstrating that the fabrication process can be scaled to larger surface areas. These films are promising for radiofrequency cavity applications because they are thick (50-75 times the London penetration depth), have relatively large surface areas, are fabricated on metallic substrates, and have R_s values that are competitive with Cu at 77 K and are lower than Cu at 4 K. Because they are polycrystalline and unoriented, it is anticipated that their R_s values can be lowered by improving the processing technique. High-quality films of $YBa_2Cu_3O_7$ have been electron-beam deposited onto 1" $LaGaO_3$ and 1.5" $LaAlO_3$ substrates. The 1" sample is characterized by R_s values of 0.2 $\pm$ 0.1 mΩ at 4 K and 18.6 $\pm$ 2 mΩ at 77 K. The 4-K value is only 2-4 times higher than Nb. The 1.5" sample has R_s values (measured at 18 GHz) of 0.93 $\pm$ 2 mΩ and 71 $\pm$ 3 mΩ at 10 K and 77 K, respectively. 18 refs., 8 figs.

2922 (LA-UR--89-4011) **Microstructures of Y123 films on $SrTiO_3$, $LaGaO_3$ and $LaAlO_3$.** Roy, T.; Raistrick, I.D.; Mitchell, T.E. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-36. (CONF-891119--10: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003367. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Transmission electron microscopy (TEM) and scanning electron microscopy (SEM) have been used to study the microstructural features of $YBa_2Cu_3O_7$ (hereafter referred to as Y123) films grown on various single crystal substrates by electron beam deposition. The films are all of high quality with the best observed J_c value being 3 $\times$ 10^7 A$\cdot$cm^{-2} at 7 K. Cross-sectional views in TEM have shown that the morphology of the film depends on its thickness. Thinner films (2500 Å) have a single layer of Y123 oriented with its c-axis perpendicular to the substrate while thicker films (8000 Å) have this same c-axis perpendicular layer closest to the interface with a c-axis parallel layer above it. The interface between the film and the substrate is well defined in all cases with no amorphous region at

the interface. Chemical analysis shows some inter-diffusion between the film and the substrate. 3 refs., 6 figs.

2923 (LBL–27657) **Electronic materials high-T_c superconductivity polymers and composites structural materials surface science and catalysts industry participation: Annual report, 1988.** Lawrence Berkeley Lab., CA (USA). [1988]. 190p. Sponsored by U.S. Department of Defense; U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research; U.S. DOE Fossil Energy; Electric Power Research Institute; National Aeronautics and Space Administration; National Science Foundation. DOE Contract AC03-76SF00098. Order Number DE90002377. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The fifth year of the Center for Advanced Materials was marked primarily by the significant scientific accomplishments of the research programs. The Electronics Materials program continued its work on the growth and characterization of gallium arsenide crystals, and the development of theories to understand the nature and distribution of defects in the crystals. The High-T_cSuperconductivity Program continued to make significant contributions to the field in theoretical and experimental work on both bulk materials and thin films and devices. The Ceramic Processing group developed a new technique for cladding YBCO superconductors for high current applications in work with the Electric Power Research Institute. The Polymers and Composites program published a number of important studies involving atomistic simulations of polymer surfaces with excellent correlations to experimental results. The new Enzymatic Synthesis of Materials project produced its first fluorinated polymers and successfully began engineering enzymes designed for materials synthesis. The structural Materials Program continued work on novel alloys, development of processing methods for advanced ceramics, and characterization of mechanical properties of these materials, including the newly-documented characterization of cyclic fatigue-crack propagation behavior in toughened ceramics. Finally, the Surface Science and Catalysis program made significant contributions to the understanding of microporous catalysts and the nature of surface structures and interface compounds.

2924 (N–89-17298, pp. 357-368) **Thermal expansion mismatch and plasticity in thermal barrier coating.** Chang, G.C. (Cleveland State Univ., OH (USA)); Phucharoen, W.; Miller, R.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The basic objective of this investigation is the quantitative determination of stress states in a model thermal barrier coating (TBC) as it cools in the air to 600 C from an assumed stress-free state at 700 C. This model is intended to represent a thin plasma-sprayed zirconia-yttria ceramic layer with a nickel chromium-aluminum-yttrium bond coat on a cylindrical substrate made of nickel-based superalloys typically found in gas turbines.

2925 (N–89-17298, pp. 369-375) **Thermal barrier coating life-prediction model development.** Strangman, T.E.; Neumann, J.F.; Liu, A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The primary objective of this program was to develop an operative thermal barrier coating (TBC) design model for life prediction. The objective was successfully accomplished with the development, calibration, and demonstration of a mechanistic thermochemical model which rapidly predicts TBC life as a function of engine, mission, and materials system parameters. This thermochemical design model accounts for the three operative TBC damage modes (bond coating oxidation, zirconia toughness reduction, and molten salt film damage), which all contribute to spalling of the insulating zirconia layer.

2926 (N–89-17298, pp. 377-393) **Thermal barrier coating life prediction model.** Pilsner, B.; Hillery, R.; Mcknight, R.L.; Cook, T.; Hartle, M. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objectives of this research were to determine the predominant modes of degradation of a plasma sprayed thermal barrier coating (TBC) system, and then to develop and verify life prediction models accounting for these degradation modes. The TBC system consists of a low pressure plasma sprayed (LPPS) bond coat layer of Ni-22Cr-10Al-O.3Y, an air plasma sprayed (APS) yttria partially stabilized zirconia (ZrO sub 2-8Y sub 2 O sub 3) top coat on a conventionally cast Rene 80 (Ni base) substrate. Thermal cycle testing of TBCs was employed to evaluate the effect of coating edges, bond coat oxidation, bond coat creep, top coat thickness, and bond coat thickness.

2927 (N–89-17298, pp. 385-399) **Thermal barrier coating life prediction model development.** Demasi, J.T.; Manning, S.L.; Ortiz, M.; Sheffler, K.D. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objectives of this program are to increase understanding of thermal barrier coating (TBC) degradation and failure modes, to generate quantitative ceramic failure life data under cyclic thermal conditions which simulate those encountered in gas turbine engine service, and to develop an analytical methodology for prediction of coating life in the engine. Observations of degradation and failure modes in plasma deposited ceramic indicate that spallation failure results from progressive cracking of the ceramic parallel to and adjacent to, but not coincident with the metal-ceramic interface.

2928 (N–89-27038) **Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz.** Miranda, F.A.; Gordon, W.L.; Heinen, V.O.; Ebihara, B.T.; Bhasin, K.B. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Jul 1989. 10p. (NASA-TM–102123;E–4903;NAS–1.15:102123;CONF-890701–: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Available from NTIS, PC A02/MF A01.

A knowledge of the dielectric properties of microwave substrates at low temperatures is useful in the design of superconducting microwave circuits. Results are reported for a study of the complex permittivity of sapphire (Al_2O_3), magnesium oxide (MgO), silicon oxide (SiO_2), lanthanum aluminate ($LaAlO_3$), and zirconium oxide (ZrO_2), in the 20 to 300 Kelvin temperature range, at frequencies from 26.5 to 40.0 GHz. The values of the real and imaginary parts of the complex permittivity were obtained from the scattering parameters, which were measured using a HP-8510 automatic network analyzer. For these measurements, the samples were mounted on the cold head of a helium gas closed cycle refrigerator, in a specially designed vacuum chamber. An arrangement of wave guides, with mica windows, was used to connect the cooling system to the network analyzer. A decrease in the value of the real part of the complex permittivity of these substrates, with decreasing temperature, was observed. For MgO and Al_2O_3, the decrease from room temperature to 20 K was of 7 and 15 percent, respectively. For $LaAlO_3$, it decreased by 14%, for ZrO_2 by 15%, and for SiO_2 by 2%, in the above mentioned temperature range.

2929 (N–89-27836) **Ion beam and plasma methods of producing diamondlike carbon films.** Swec, D.M.; Mirtich, M.J.; Banks, B.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Aug 1988. 17p. (NASA-TM–102301;E–4980;NAS–1.15:102301;CONF-880887–: 32. international technical symposium on optical and opto-electronic applied science and engineering, San Diego, CA (USA), 14-19 Aug 1988). Available from NTIS, PC A03/MF A01.

A variety of plasma and ion beam techniques was employed to generate diamondlike carbon films. These methods included the use of RF sputtering, dc glow discharge, vacuum arc, plasma gun, ion beam sputtering, and both single and dual ion beam deposition. Since films were generated using a wide variety of techniques, the

physico-chemical properties of these films varied considerably. In general, these films had characteristics that were desirable in a number of applications. For example, the films generated using both single and dual ion beam systems were evaluated for applications including power electronics as insulated gates and protective coatings on transmitting windows. These films were impervious to reagents which dissolve graphitic and polymeric carbon structures. Nuclear reaction and combustion analysis indicated hydrogen to carbon ratios to be 1.00, which allowed the films to have good transmittance not only in the infrared, but also in the visible. Other evaluated properties of these films include band gap, resistivity, adherence, density, microhardness, and intrinsic stress. The results of these studies and those of the other techniques for depositing diamondlike carbon films are presented.

2930 (ORNL/FTR–3107) **[Ceramic powder processing]: Foreign trip report, October 7–15, 1988.** Crosbie, G.M. Oak Ridge National Lab., TN (USA). 31 Oct 1988. 37p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90002139. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler attended and presented a technical paper at the Second International Powder Processing Conference and participated in the data analysis of the working group meeting of the International Energy Agreement Annex II. Of particular interest were discussions and papers about the status of German projects for Si_3N_4 powder characteristics for sinterability, tests relating Si_3N_4 ceramic properties to powder properties, and advances in understanding hardness of agglomerates and dry-pressing theory. These advances in ceramic technology are likely to be bases for improvements in several energy R&D activities. In the IEA meeting, the traveler presented a discussion of the X-ray diffraction methods which were used in Ford's contributions to the round robin. 8 refs., 9 figs.

2931 (ORNL/FTR–3445) **[Fabrication of superconducting films]: Foreign trip report, September 23, 1989–October 11, 1989.** Sekula, S.T. Oak Ridge National Lab., TN (USA). 26 Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002153. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler visited the University of Cambridge and the associated Interdisciplinary Research Centre (IRC) on Superconductivity. The IRC is structured around collaborating departments within the university to establish a balanced program of basic research and work directed toward applications. At the International Conference on High-T_c Thin Films and Single Crystals, the traveler presented an invited paper and chaired a session on single-crystal growth. In roughly equal fractions, the papers at the conference were concerned with studies of thin-film and single crystals. Topics discussed included structural and superconducting characterization and potential device applications that are of interest to programs at ORNL. The traveler also visited the Institute of Physics in Warsaw and the Institute of Low Temperature and Structure Research in Wroclaw for discussions of current research in superconductivity.

2932 (PB–89-225700/XAB) **Resistivity measurements of superconducting materials. Master's thesis.** Akhtar, G. Quaid-i-Azam Univ., Islamabad (Pakistan). 1988. 139p. Available from NTIS, PC EE06/MF A01.

To study the electrical resistivity of high-temperature superconductors, a four-probe setup was constructed. Resistivity measurements as a function of temperature (77-300K) were studied for the systems R-Ba=Cu-O (R= Ho,Dy). The superconducting transition was observed for $DyBa_2Cu_3O_7$ and $HoBa_2Cu_3O_7$ around 90K.

2933 (PB–89-870570/XAB) **Sialon ceramics. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 164p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868674.

This bibliography contains citations concerning the properties, preparation, fabrication, testing, and applications of SIALON (SI–AL–O–N, the constituents) ceramics. Applications include utilization in gas-turbine components, cutting tools, heat exchangers, and other high-temperature/high-stress components. Sintering methods and materials, and microstructural analyses are discussed. Japanese research and development is included. (This updated bibliography contains 282 citations, 23 of which are new entries to the previous edition.)

2934 (UCRL-Trans–12253) **Structure of niobium carbides.** (Structure des carbures de niobium). Terao, Nobuzo. 18p. Translated from Japanese Journal of Applied Physics (Japan). *Japanese Journal of Applied Physics (Japan),* 3(2): 104-111 (Feb 1964). Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48.

The preparation of thin films of two niobium carbides, NbC and Nb_2C, for electron diffraction studies has been accomplished by heating in vacuo double evaporated films (carbon + Nb). NbC is formed by a carburization process in high vacuum, while thin films of Nb_2C are produced by decomposition of NbC in air at reduced pressure ($10^{-2} \sim 10^{-3}$ Torr) by the reaction $2\ NbV + O_2 \rightarrow Nb_2C + CO_2$. The crystal structure of NbC is based on the f.c.c. lattice of Nb atoms and the carbon atoms occupy interstitial positions in a statistical manner. Nb_2C, however, shows a hexagonal superlattice structure of the same type as that of ε-phase of Fe_2N. 2 figs., 2 tabs.

2935 High resolution electron microscopic study of the growth of denser phases on zeolite Y and zeolite L. Zandbergen, H.W. (National Center for Electron Microscopy, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). vp of Microstructure and properties of catalysts. Treach, M.M.J.; Thomas, J.M.; White, J.M. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711205–: Symposium on microstructure and properties of catalysts, Boston, MA (USA), 30 Nov - 3 dec 1987).

High resolution electron microscopy (HREM) is a powerful tool in materials research. This is especially true in the study of zeolites because most of the questions concerning the properties of zeolites require a detailed characterization of the local structure. In this paper the potential of HREM is illustrated with studies on the growth of denser phases on Zeolite Y and Zeolite L.

2936 The charge state of iron ions implanted into sapphire. McHargue, C.J. (Oak Ridge National Lab., Oak Ridge, TN (US)); Sklad, P.S.; White, C.W.; Farlow, G.C.; Perez, A.; Kornilios, N.; Marest, G. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC05-84OR21400. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

Single crystals of α-Al_2O_3 were implanted with $^{57}Fe^+$ at room temperature to fluences ranging from 10^{16} to 10^{17} ions/cm^2. This paper discusses the damage in the implanted zone and the valence states and local environment of implanted ions studied by transmission electron microscopy, Rutherford backscattering-channelling, and conversion electron Mossbauer spectroscopy. The implanted iron was distributed among the three charge states Fe^{2+}, Fe^{3+}, and Fe^0 (metallic clusters) with the relative amount of each varying with concentration of implanted iron.

2937 Lattice mode study of La_2CuO_{4-y} implanted with Sr. Ohana, I. (Massachusetts Institute of Technology, Cambridge, MA (US)); Doll, G.L.; Lusnikov, A.; Dresselhaus, M.S.; Withrow, S.P.; Picone, P.J.; Jenssen, H.P.; Gabbe, D.R.; Dresselhaus, G. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC05-84OR21400. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

In this paper dramatic implantation-induced changes in the Raman and infrared spectra of polycrystalline samples of La_2CuO_{4-y} are reported for implantation of Sr in the fluence range 0.5 to 1.5 $X10^{16}$/cm^2. The Raman and ir-reflectance spectra of the Sr implanted material reveal disorder-induced lines corresponding to breakdown of selection rules and to non-zone-center phonon modes. Whereas the main features in the Raman spectra of the implanted sample are broad disorder-induced lines centered at –

560+-5 cm^{-1}, reststrahlen lineshapes are observed above – 800 cm^{-1} in the ir-reflectance spectra. After thermal annealing (550°C), the multiphonon lines in the ir spectra diminish, and the disorder-induced lines in the Raman spectra split to form well-resolved, sharper lines at 530 and 580 cm^{-1}, identified with maxima in the phonon density of states.

2938 Synthesis of oxide powders by plasma vaporization of solutions. Pollinger, J.P. (Pennsylvania State Univ., Univ. Pk., PA); Messing, G.L. vp of Ceramic powder science. Messing, G.L.; McCauley, J.W.; Mazdiyasni, K.S.; Haber, R.A American Ceramic Society Inc., Westerville, OK (1987). (CONF-860883–: Ceramic powder science and technology: synthesis, processing, and characterization conference, Boston, MA (USA), 3-6 Aug 1986).

The synthesis of single and multicomponent oxide powders by the plasma vaporization of solutions (PVS) technique is reviewed. Previous investigations of the synthesis of MgO, Al_2O_3, Fe_2O_3, ZrO_2, and SiO_2-ZrO_2 powders are discussed, as well as the results of recent experiments in the laboratory on the effect of precursor composition on the morphology, structure, composition, and particle-size distribution on PVS-synthesized MgO, Al_2O_3, and Al_2O_3-MgO powders.

2939 Plasma synthesis and characterization of ultrafine SIC. Vogt, G.J. (Los Alamos Nat. Lab., Los Alamos, NM); Phillips, D.S.; Taylor, T.N. vp of Ceramic powder science. Messing, G.L.; McCauley, J.W.; Mazdiyasni, K.S.; Haber, R.A American Ceramic Society Inc., Westerville, OK (1987). (CONF-860883–: Ceramic powder science and technology: synthesis, processing, and characterization conference, Boston, MA (USA), 3-6 Aug 1986).

Ultrafine SiC powders were prepared by gas-phase synthesis from silane and methane in an argon thermal rf-plasma. Bulk properties of the powders were determined by elemental analysis, X-ray diffraction, helium pycnometry, and BET surface area measurements. The near-surface composition and structure of the particles were examined by X-ray photoelectron spectroscopy (XPS) and transmission electron microscopy (TEM). In addition to free silicon and carbon particles in the powders, free carbon and various silicon/carbon/oxygen species were found on the surface of the SiC particles. The presence of these surface species will dominate the powder surface chemistry, having important implications for powder processing and consolidation.

2940 Optical waveguide formation by ion implantation of Ti or Ag. Poker, D.B. (Oak Ridge National Lab., Oak Ridge, TN (US)); Thomas, D.K. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC05-84OR21400. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

In this paper ion implantation of Ti into $LiNbO_3$ is shown to be an effective means of producing optical waveguides, while maintaining better control over the resulting concentration profile of the dopant than can be achieved by in-diffusion. While undoped, amorphous $LiNbO_3$ can be regrown by solid-phase epitaxy at 400°C with a regrowth velocity of 250 A/min, the higher concentrations of Ti required to form a waveguide (–10%) slow the regrowth considerably, so that temperatures approaching 800°C are used. The regrowth is completed at 400°C, and annealing of all residual damage occurs at or below 800°C. Furthermore, the regrowth rate is independent of Ag concentration up to the highest dose implanted to data. The usefulness of Ag implantation for the formation of optical waveguides is discussed.

2941 A cross-sectional TEM study of the effects of annealing conditions on the regrowth of lead-implanted single crystal calcium titanate. Rankin, J. (Massachusetts Institute of Technology, Cambridge, MA (US)); Hobbs, L.W.; Boatner, L.A.; White, C.W. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC05-84OR21400;FG02-84ER45090. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes the study of the atmospheric effects of oxygen and water vapor on the epitaxial regrowth behavior or ion-implanted $CaTiO_3$. Cross-sectional transmission electron microscopy (TEM) samples prepared from crystals implanted with $1(10^{15})$ Pb/cm^2 at 540 KeV, were annealed at 450-650°C for 40 - 80 minutes, in environments containing different percentages of oxygen and water vapor. Regrowth was studied for implantation directions along both the <010> and <100> crystallographic directions of this orthorhombic Perovskite structure, space group Pcmn. TEM on unannealed crystals indicated the presence of an amorphous region.

2942 Dispersion and rheology in ceramic processing. Sacks, M.D. (Univ. of Florida, Gainesville, FL); Khadilkar, C.S.; Scheiffele, G.W.; Shenoy, A.V.; Dow, J.H.; Sheu, R.S. vp of Ceramic powder science. Messing, G.L.; McCauley, J.W.; Mazdiyasni, K.S.; Haber, R.A American Ceramic Society Inc., Westerville, OK (1987). (CONF-860883–: Ceramic powder science and technology: synthesis, processing, and characterization conference, Boston, MA (USA), 3-6 Aug 1986).

Rheology plays an important role in most aspects of ceramic processing, including performing operations(e.g., mixing, milling, etc.), shape-forming operations (e.g., slip casting, tape casting, injection molding, extrusion, fiber drawing, spray granulation, etc.), coating (deposition processes (e.g., dipping, spinning, spraying, etc.), and drying (e.g., liquid transport in pores) and densification (e.g., liquid-phase sintering). Proper control over rheological properties is important, not only to maximize processing efficiency, but also to optimize the physical properties of the processed materials. In particle/liquid systems, rheological properties are especially sensitive to the state of particulate dispersion. Well-dispersed systems, in which primary particles are well separated in the liquid medium, are generally desirable in suspension-forming operations (e.g., slip casting, tape casting, etc.). In this paper, some of the important factors affecting the state of dispersion in particle/liquid systems are discussed in the context of several illustrative examples. The utility of rheological measurements in characterizing the state dispersion and optimizing processing conditions is demonstrated.

2943 Pulsed laser mixing of metal overlayers on ceramics. Singh, R.K. (North Carolina State Univ., Raleigh, NC (US)); Biunno, N.; Narayan, J. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes pulsed laser mixing used as surface modification technique for the improvement in the mechanical properties of ceramics. Thin metallic layers of nickel were deposited on structural silicon nitride and were irradiated with Xenon Chloride (XeCl) laser pulses. The laser parameters were optimized to lead to the formation of mixed layers. The mixed interfacial layers were analyzed using Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and Rutherford Backscattering (RBS) techniques.

2944 Microwave cavity studies for thermal testing of ceramic breeder materials. Kustom, R. (Argonne National Lab., Argonne, IL 60439 (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-31-109-ENG-38. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Dielectric heating of proposed ceramic tritium breeder material to study the thermomechanical and thermal-hydraulic properties of the material has been previously suggested. Recent computer studies using codes capable of modelling three-dimensional EM cavities with enclosed dielectric material have been used to determine the size limitations of cavity designs at 200MHz. The sample can be as large as 0.44 x 0.72 m in the plane that is transverse to the direction of neutron flux. The uniformity of volumetric heating over the transverse plane is constant to within a few percent. The sample can be as long as 10 cm in the direction of the heat flux and match the expected exponential decay of heat generation, $\exp(-z/\lambda)$, to within +-8%. The design of the chamber is described, including the sample region, additional dielectric loading blocks on two sides of

the sample region that are required to generate the field uniformity in the transverse plane, and a description of the matching-section portion of the cavity which provides the correct geometry to cause the cavity to resonate at 200 MHz with the right z dependent to simulate the exponentially-decaying heat profile in the sample region.

2945 Effect of heat treatment time and temperature of the properties of $YBa_2Cu_3O_{7-x}$. Bloom, I. (Chemical Technology Division, Argonne National Laboratory, Argonne, Illinois 60439-4837 (US)); Tani, B.S.; Hash, M.C.; Shi, D.; Patel, M.A.; Goretta, K.C.; Chen, N.; Capone, D.W.,II. *Journal of Materials Research (USA)*, 4(5): 1093-1098 (Sep 1989). DOE Contract W-31109-ENG-38.

Two $YBa_2Cu_3O_{7-x}$ powders were investigated: one was stoichiometric, and the other, CuO-rich. After being sintered at 950 °C, samples from both powders were heat-treated in oxygen at 845, 860, and 910 °C for up to 10 days. The samples were characterized by differential thermal analysis, x-ray diffraction, optical and scanning electron microscopy, iodometric titrations, and measurement of their superconducting properties (electrical resistivity, critical temperature, and critical current density). The electrical properties of the nearly stoichiometric material improved with time at all temperatures. On the other hand, the electrical properties of the CuO-rich material deteriorated with temperature, possibly owing to problems associated with grain growth at 910 °C.

2946 Raman spectroscopy of nanophase TiO_2. Melendres, C.A. (Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439-4837 (US)); Narayanasamy, A.; Maroni, V.A.; Siegel, R.W. *Journal of Materials Research (USA)*, 4(5): 1246-1250 (Sep 1989). DOE Contract W-31109-ENG-38.

Raman spectra are reported for consolidated nanophase TiO_2 particles in their as-compacted state and after annealing at a variety of temperatures up to 1273 K. The Raman-active bands normally observed for the rutile form of TiO_2 were present in as-compacted samples having average grain sizes in the range from about 10 to 100 nm. However, significant broadening of these bands was found, which was uncorrelated with initial grain size, but not necessarily with other synthesis-related factors. This broadening decreased upon isochronal annealing at elevated temperatures in air. Based upon these observation, it is concluded that nanophase TiO_2 in the as-consolidated state contains significant defect concentrations within the rutile grains and that these intragrain defects and the grain-boundary regions as well have local atomic structures with the rutile symmetry, albeit with some short-range displacements. Some sporadic sample regions containing small amounts (<5) of the anatase form of TiO_2 were also found; these traces of anatase transformed to rutile upon annealing in air at temperatures above 883 K.

2947 Lattice defects and flux pinning in crystallized metal-oxide glasses in the Bi-Sr-Ca-Cu-O system. Shi, D. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Chen, J.G.; Welp, U.; Boley, M.S.; Zangvil, A. *Applied Physics Letters (USA)*, 55(13): 1354-1356 (25 Sep 1989). DOE Contract W-31-109-ENG-38.

Large amounts of lattice defects have been observed in the crystallized metal-oxide glasses in the Bi-Sr-Ca-Cu-O system prepared by the rapid solidification method. The density of such defects has been found to greatly increase as the calcium and copper content of the starting material increases. These lattice defects are formed as a result of supersaturation of calcium and copper in the sample matrix. The intragrain critical current density has been found to increase 30 times in magnitude as the density of the lattice defects is increased in the sample matrix. The corresponding flux pinning mechanisms are discussed.

2948 States of partial order in $YBa_2Cu_3O_x$. de Fontaine, D. (Department of Materials Science and Mineral Engineering, University of California, Berkeley, Berkeley, California 94720 Department of Physics, University of California, Berkeley, Berkeley, California 94720 (US)); Mann, M.E.; Ceder, G. *Physical Review Letters (USA)*, 63(12): 1300-1303 (18 Sep 1989).

Monte Carlo simulation has been performed on a previously proposed model of oxygen ordering in $YBa_2Cu_3O_x$: A two-dimensional Ising model with isotropic first-neighbor and anisotropic second-neighbor effective pair interactions in the "chain plane." At low temperatures, states of partial order are observed in agreement with experimental findings. Such states of quasi-one-dimensional order are a consequence of the asymmetric nature of the interactions.

2949 Variation of T_{c0} in the 110 K superconductor $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$. Ganapathi, L. (Department of Materials Science and Engineering, North Carolina State University, Raleigh, North Carolina 27695-7916 (US)); Narayan, J.; Kumar, A. *Applied Physics Letters (USA)*, 55(14): 1460-1462 (2 Oct 1989).

We have systematically investigated resistance of a bismuth cuprate $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$ as a function of different annealing treatments. X-ray diffraction and transmission electron microscopy studies were performed on concomitant specimens for correlations between structure and superconducting properties. A sharp 110 K superconducting transition was observed in the sample which was isostructural with the n=2 member of the $(Bi,Pb)_2(Ca,Sr)_{n+1}Cu_nO_{2n+4+\delta}$ family. The zero resistance transition temperature T_{c0} was found to be sensitive to annealing at 673 K with a best result of 100 K for 30 min annealing. It is proposed that T_{c0} and transition width in bismuth cuprates are sensitive to oxygen stoichiometry.

2950 Break junction measurement of the tunneling gap of a thallium-based high-temperature superconductor crystal. Moreland, J. (Electromagnetic Technology Division, National Institute of Standards and Technology, Boulder, Colorado 80303 (US)); Ginley, D.S.; Venturini, E.L.; Morosin, B. *Applied Physics Letters (USA)*, 55(14): 1463-1465 (2 Oct 1989).

We have used the break junction method to measure the tunneling gap of a thallium-based high-temperature superconductor crystal in liquid helium at 4 K. The crystal was predominantly $Tl_2CaBa_2Cu_2O_7$ and had a superconducting onset temperature of 105 K. Tunneling data showed a symmetric gap about zero bias between two well-defined conductance peaks in the conductance versus voltage curve. The gap is consistent with a Bardeen–Cooper–Schrieffer energy gap (Δ) of 30 meV assuming a superconductor-insulator-superconductor electrode configuration. In addition, a supercurrent could be detected when the break junction was operated in a point-contact mode at temperatures as high as 95 K.

2951 Ion implantation of sputtered Y-Ba-Cu-O films. Rubin, M. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720 (US)); Brown, I.G.; Yin, E.; Wruck, D. *Journal of Applied Physics (USA)*, 66(8): 3940-3942 (15 Oct 1989).

Thin films of Y-Ba-Cu-O were deposited by rf magnetron sputtering from a single stoichiometric target and then altered in composition by ion implantation. Under optimum deposition conditions the films are deficient in Ba and Cu. Ion implantation of Cu was performed using a metal-vapor vacuum-arc source having high current and a broad energy spectrum for good depth distribution. Composition was determined by Rutherford backscattering spectrometry. The zero-resistance temperature was greatly increased after implantation and reannealing. This method could be used to write superconducting patterns on insulating material.

2952 Molecular structure and thermal stability of B_2H_4 and $B_2H^+_4$ species. Ruscic, B. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Schwarz, M.; Berkowitz, J. *Journal of Chemical Physics (USA)*, 91(8): 4576-4581 (15 Oct 1989). DOE Contract W-31-109-ENG-38.

B_2H_4 has been produced by the reaction of F atoms with B_2H_6, in successive abstraction reactions. The B_2H_4 species was detected and analyzed by photoionization mass spectrometry. The adiabatic ionization potential of this species (9.70±0.02 eV) and the vertical value (~10.4 eV) are obtained from the photoion yield curve. These values, and the shape of this curve, are consistent with a doubly bridged, C_{2v} structure for both the neutral and ionic species. The fragment ion $B_2H^+_2$ is observed, with an appearance potential of 11.53_5±0.03 eV. This value, combined with previous results, yields $D_0(B_2H_4–H)\approx 40.1$ kcal/mol, whereas $D_0(B_2H_5–H)\lesssim 102.7$ kcal/mol. The $B_2H^+_2$ fragment may have as its neutral precursor an isomeric B_2H_4 (D_{2d}), with approximately the same stability as the C_{2v} species. An earlier value for the appearance potential of $B_2H^+_4$ from B_2H_6 is shown to be too high, due to a very small formation probability at the thermochemical threshold.

2953 Further theoretical studies on B_2H_4 and $B_2H^+_4$. Curtiss, L.A. (Argonne National Laboratory, Chemical Technology Division/Materials Science Division, Argonne, Illinois 60439-4837 (US)); Pople, J.A. *Journal of Chemical Physics (USA),* 91(8): 5118-5119 (15 Oct 1989). DOE Contract W-31-109-ENG-38.

The vertical ionization potentials of the D_{2d} and C_{2v} structures of B_2H_4 are reported at the G1 level of *ab initio* molecular orbital theory. The results support the interpretation by Ruscic, Schwarz, and Berkowitz of their new photoionization experiment in terms of a C_{2v} bridged structure of B_2H_4. In addition, the bridged C_{2v} $B_2H^+_4$ cation is found to have a very small barrier to inversion (1 kcal/mol).

2954 Superconducting properties of a single-crystal sphere of $ErRh_4B_4$. Behroozi, F. (Biomolecular Engineering Branch, Naval Research Laboratory, Washington, D.C. 20375 (US)); Hall, L.N.; Crabtree, G.W.; Hinks, D.G. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 6548-6557 (1 Oct 1989).

We report on the superconducting and magnetic properties of a single-crystal sphere of the primitive tetragonal phase of $ErRh_4B_4$. Our data consist of magnetization and susceptibility measurements in fields up to 50 kOe and at temperatures down to 0.4 K. The crystal exhibits extreme anisotropy in its response to a magnetic field. It is a weak paramagnet when the external field is along the tetragonal $\bar{c}$ axis but reverts to a strong paramagnet when the field is in the basal plane. The magnetization curves reveal a first-order phase transition at H_{c2} when the field is in the basal plane. Evidence for a temperature domain in which superconductivity and long-range ferromagnetic order appear to coexist is also presented. The magnetization curves are further analyzed to obtain the critical fields, the Ginzburg-Landau parameters, Curie plot, and the ferromagnetic moment of the system.

2955 Heat capacities of LaD_x and LaH_x ($1.9 \leq x \leq 3.0$) from 1 to 300 K. Kai, K. (Ames Laboratory, Iowa State University, Ames, Iowa 50011 (JP)); Gschneidner, K.A. Jr.; Beaudry, B.J.; Peterson, D.T. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 6591-6600 (1 Oct 1989).

The heat capacities of lanthanum hydrides in the LaD_x and LaH_x ($1.9 \leq x \leq 3.0$) series have been measured over the temperature range from 1.2 to 300 K. The electronic specific-heat coefficients showed nearly the same variation for both LaD_x and LaH_x over the entire composition range, having the values of $\gamma = 0.81 \pm 0.01$ and 0.038 ± 0.01 mJ/g-at. K^2 at the stoichiometric compositions of LaD_2 (LaH_2) and LaD_3 (LaH_3), respectively. Some different variations were found in the composition dependence of the Debye temperatures of the LaD_x and LaH_x series, but, nevertheless, the same values of $FTHETA_D = 348 \pm 2$ and 381 ± 2 K were found at the compositions of LaD_2 (LaH_2) and LaD_3 (LaH_3), respectively. The variations of γ and $FTHETA_D$ do not show a monotonic behavior but depend on the formation of the three hydrogen-ordering phases, namely, $LaD(H)_{2.25}$, $LaD(H)_{2.5}$, and $LaD(H)_{2.75}$. One sharp heat-capacity peak was found in LaD_x between $x = 2.65$ and 2.90, associated with octahedral hydrogen ordering centered at $LaD_{2.75}$, whereas four sharp peaks were found in $LaD_{2.95}$ at 215.5, 265.5, 286.8, and 293.8 K and were correlated with the four transitions observed in LaD_3 by Ito *et al.* The metal-to-semiconductor transition, which is found in the alloys between $2.75 \leq x \leq 3.0$, is discussed on the basis of the electronic specific-heat coefficient and recent theoretical work. We also report that $LaH_{2.01}$ becomes a superconductor at 0.17 K and, if $LaD_{2.06}$ goes superconducting, it does so below 0.06 K.

2956 Electronic structure of $Pb_2Sr_2PrCu_3O_8$ as studied by resonant photoemission spectroscopy. Dessau, D.S. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305 (US)); Shen, Z.; Lindberg, P.A.P.; Wells, B.O.; Borg, A.; Lindau, I.; Spicer, W.E.; Waszczak, J.V.; Schneemeyer, L.F. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 6726-6730 (1 Oct 1989).

Resonant photoemission spectroscopy has been used to study the electronic structure of the recently discovered high-temperature superconductor $Pb_2Sr_2PrCu_3O_8$. The valence-band features are compared with those from other high-temperature superconductors and with band-structure calculations. A strong Cu $3d^8$ satellite arises at approximately the same energy position as in the other high-T_c superconductors, implying that to first order the model parameter U_{dd} will be quite similar. A 0.7-eV shift to higher binding energy of the band-theoretical density of states is required to obtain the best agreement with the photoemission spectra. The strong Cu $3d^8$ satellite and the discrepancy between the band theory and the photoemission spectra show the importance of correlations in this material. The valency of Pr in the material was observed to be 3+, as it had been in $PrBa_2Cu_3O_7$. The extracted Pr 4*f* spectral weight suggests that the hybridization of the Pr 4*f* states with the in-plane O states is reduced, as compared to $PrBa_2Cu_3O_{7-\delta}$. This is plausible, as the interplanar spacing is larger in this material than in $PrBa_2Cu_3O_{7-\delta}$. We infer that this hybridization is important for the quenching of the superconductivity in $PrBa_2Cu_3O_{7-\delta}$ and explains why the superconductivity is not quenched in $Pb_2Sr_2Pr_{1-x}Ca_xCu_3O_8$.

2957 ^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors. Oldfield, E. (School of Chemical Sciences, University of Illinois at Urbana-Champaign, 505 South Mathews Avenue, Urbana, Illinois 61801 (US)); Coretsopoulos, C.; Yang, S.; Reven, L.; Lee, H.C.; Shore, J.; Han, O.H.; Ramli, E. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 6832-6849 (1 Oct 1989).

We have obtained solid-state ^{17}O NMR spectra of a number of ^{17}O-enriched oxides and high-temperature oxide superconductors, including $Cu_2{}^{I}O$, $Cu^{II}O$, $KCu^{III}O_2$, Bi_2O_3, Tl_2O_3, $La_{1.85}Sr_{0.15}CuO_4$, $YBa_2Cu_3O_{7-x}$, $Bi_2Sr_2CaCu_2O_{8+x}$, $Tl_2Ba_2CaCu_2O_{8+x}$, and $Ba_{0.6}K_{0.4}BiO_3$. Spectra of all of the simple diamagnetic oxides contain relatively sharp resonances in a "diamagnetic" region of ~ -200 to $+700$ ppm (from H_2O, International Union of Pure and Applied Chemistry δ scale). $Cu^{II}O$ exhibits a broad resonance centered at ~ 4500 ppm.

2958 Superconducting energy gap and a normal-state excitation in $Ba_{0.6}K_{0.4}BiO_3$. Schlesinger, Z. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598 (US)); Collins, R.T.; Calise, J.A.; Hinks, D.G.; Mitchell, A.W.; Zheng, Y.; Dabrowski, B.; Bickers, N.E.; Scalapino, D.J. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 6862-6866 (1 Oct 1989). DOE Contract W-31-109-ENG-38.

We report the first measurement of the energy gap of the high-temperature bismuth oxide superconductor $Ba_{0.6}K_{0.4}BiO_3$ ($T_c \simeq 30$ K). With temperature- and magnetic-field-dependent infrared reflectivity measurements, we obtain a reduced energy gap of $2\Delta/kT_c \simeq 3.5 \pm 0.5$, consistent with a BCS-type mechanism with moderate or weak coupling. In the normal state a broad peak in the infrared conductivity is observed near 5000 cm^{-1}. This unusual infrared behavior is common to both the $BaPb_{1-x}Bi_xO_3$ and the $Ba_{1-x}K_xBiO_3$ systems and may provide a fundamental clue to the mechanism of superconductivity in the cubic bismuth oxides.

2959 Effects of oxygen and strontium vacancies on the superconductivity of single crystals of $Bi_2Sr_{2-x}CuO_{6-y}$. Sonder, E. (Oak Ridge National Laboratory, Solid State Division, Oak Ridge, Tennessee (US)); Chakoumakos, B.C.; Sales, B.C. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 6872-6877 (1 Oct 1989). DOE Contract AC05-84OR21400.

Single crystals of $Bi_2Sr_{2-x}CuO_{6-y}$ (2201 phase) were grown from CuO-rich melts. The Sr concentration in the crystals was varied from $x = 0.1$ to 0.5 by adjusting the starting composition of the melt, and the oxygen content of the crystals was reversibly adjusted between $y = 0$ and 0.5 by an appropriate heat treatment of the crystals in a thermogravimetric system. With decreasing Sr content the superconducting transition temperature, T_c, of the crystals decreased rapidly from 9 K to below 4.2 K, and the resistivity in the *a-b* plane changed from metallic (linear in T from 30 to 300 K) to semiconducting. Reducing the oxygen content in the crystals had a similar effect on the resistivity. Only crystals with close to the maximum oxygen content ($y = 0$) were superconducting, and removal of oxygen from previously superconducting crystals resulted in a rapid decrease of T_c and the eventual loss of superconductivity ($T_c < 4.2$ K). A bond-valence sum analysis suggests that oxygen is removed from the Bi_2O_2 layers.

2960 Photoemission study of monoclinic $BaBiO_3$. Shen, Z. (Stanford Electronics Laboratories, Stanford University, Stanford, California 94305 (US)); Lindberg, P.A.P.; Wells, B.O.; Dessau, D.S.; Borg, A.; Lindau, I.; Spicer, W.E.; Ellis, W.P.; Kwei, G.H.; Ott, K.C.;

and others. *Physical Review [Section] B: Condensed Matter (USA)*, 40(10): 6912-6918 (1 Oct 1989). DOE Contract AC03-82ER13000.

We present the results of photoemission studies of "valence-disordered" monoclinic $BaBiO_3$ in the photon energy range 15–120 eV. The line shapes of the valence-band photoemission spectra and the Ba contributions to the valence band are similar to the line shapes of the total density of states and Ba partial density of states, respectively. The Bi 5*d* core levels show only one peak for each spin-orbit component. Oxygen resonance is observed, demonstrating the existence of empty O 2*p* states. These results support a more covalent rather than a simple ionic picture for the electronic states of $BaBiO_3$. Our data suggest that the charge fluctuation between the two unequal Bi sites is small. We also discuss the origin of the semiconducting character of the "valence-disordered" $BaBiO_3$.

2961 Mean-field theory of oxygen-vacancy ordering in $YBa_2Cu_3O_{7-\delta}$. Wille, L.T. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720 and Department of Physics, Florida Atlantic University, Boca Raton, Florida 33431 (US)). *Physical Review [Section] B: Condensed Matter (USA)*, 40(10): 6931-6940 (1 Oct 1989). DOE Contract AC03-76SF00098.

A high-temperature phase diagram and various correlation functions have been calculated for the partially occupied oxygen sublattice in the CuO basal plane of $YBa_2Cu_3O_{7-\delta}$ ($0 \leq \delta \leq 1$). This structure is modeled as a two-dimensional Ising system with repulsive first-neighbor and anisotropic, competing second-neighbor interactions. These interactions are selected to guarantee the stability (at zero temperature) of the two experimentally observed orthorhombic phases: a single-cell structure (with Cu-O chains parallel to the *b* axis) at δ=0 and a double-cell structure (with regularly spaced missing chains) at δ=0.5. The calculations are performed in the four- and five-point approximation of the cluster-variation method. The results are in good agreement with available experimental information.

2962 Calculation of optical transport and localization quantities. Economou, E.N. (Research Center of Crete and Department of Physics, P.O. Box 1527, 711 10 Iraklio, Crete, Greece (GR)); Soukoulis, C.M. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7977-7980 (15 Oct 1989). DOE Contract W-7405-ENG-82.

By combining a coherent-potential approximation with our previous work on localization, we calculate the mean free path *l*, the diffusion coefficient *D*, the localization parameter *kl*, where **k** is the renormalized wave vector, the localization length L_c, and other related quantities. Our results for *D* near the critical regime are in surprisingly impressive agreement with recent experimental data by Drake and Genack in a sample of titania spheres in air. Our calculations indicate that optical localization can be experimentally realized by either lowering the concentration of the titania spheres or lowering the standard deviation of the radii distribution.

2963 Molecular-dynamics investigation of deuteron separation in $PdD_{1.1}$. Richards, P.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185-5800 (US)). *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7966-7968 (15 Oct 1989). DOE Contract AC04-76DP00789.

A molecular-dynamics simulation was done to investigate the D-D distances in above-stoichiometric $PdD_{1.1}$. Different potentials were used in an attempt to optimize the chances of close D-D approach. At the two temperatures studied, 300 and 1300 K, no distances closer than 0.7 A were found, thus giving no evidence for the short distances needed to produce fusion in the material.

2964 Method of fabricating optical waveguides by ion implantation doping. Appleton, B.R.; Ashley, P.R.; Buchal, C.J. To Dept. of Energy, Washington, DC. USA Patent 4,840,816. 20 Jun 1989. Filed date 24 Mar 1987. 8p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method for fabricating high-quality optical waveguides in optical quality oxide crystals by ion implantation doping and controlled epitaxial recrystallization is provided. Masked $LiNbO_3$ crystals are implanted with high concentrations of Ti dopant at ion energies of about 350 keV while maintaining the crystal near liquid nitrogen temperature. Ion implantation doping produces an amorphous, Ti-rich nonequilibrium phase in the implanted region. Subsequent thermal annealing in a water-saturated oxygen atmosphere at up to 1000°C produces solid-phase epitaxial regrowth onto the crystalline substrate. A high-quality single crystalline layer results which incorporates the Ti into the crystal structure at much higher concentrations than is possible by standard diffusion techniques, and this implanted region has excellent optical waveguides properties.

2965 Process for single-crystal growth of high T(c) superconductors. Lechter, W.; Toth, L.; Badri, D. To Department of the Navy, Washington, DC (US). USA Patent Application 7-356,496. 25 May 1989. 11p. Available from NTIS, PC A03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

Large oriented crystals greater than one millimeter in length of high T_c superconducting compounds are grown by mixing starting materials in the correct proportions to make the superconducting compound, forming a mixture. The CO_2 is removed from the mixture and the ternary oxide of the compound is formed from the mixture. Next, the mixture is formed into a self-supporting green body and sintered at a sintering temperature at which the top of the self-supporting green body is molten and the bottom surface is solid. The self-supporting green body is held at the sintering temperature for a time, forming a sintered body. Next, the sintered body is cooled so that crystals form. After this step, the crystals can be further processed to increase their superconducting properties. Finally, the crystals are removed and processed for use.

3606 Other Materials

Refer also to citation(s) 2069, 2096, 2113, 2150, 2219, 2294, 2303, 2305, 2307, 2335, 2341, 2397, 2476, 2491, 2713, 2848, 2923, 3213, 3214, 3226, 3233, 3328, 3360, 3432, 4239, 4355, 4389

2966 (AD-A–210825/6/XAB) **Fracture-toughness testing of metal-matrix composites.** Tsangarakis, N.; Nunes, J.; Slepetz, J.M. Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab. Jun 1989. 21p. (MTL-TR–89-51). Available from NTIS, PC A03/MF A01.

Pub. in Engineering Fracture Mechanics, Vol. 30, No. 5, 565-577(1988).

Various specimen designs and test procedures were used to assess the fracture toughness of the following metal-matrix composites: aluminum oxide, continuous-fiber-reinforced aluminum and magnesium, and silicon carbide particulate and continuous fiber-reinforced aluminum. The following types of specimens were examined: the compact tension, the double-edge notched, the center notched, the short-rod, and the Charpy bar. The fracture-toughness values for the ceramic continuous-fiber-reinforced metal-matrix composites were found to be dependent on the geometry of the specimen. Except for cross-ply laminates, fracture tended to occur primarily parallel to fibers. It was inferred that a linear elastic fracture mechanics approach may not be appropriate for the determination of fracture toughness of these materials. The results of the particulate-reinforced metal-matrix composite encourage a further consideration of the ASTM E-399 test procedure as a standard method for the determination of fracture toughness of this type of composite.

2967 (AD-A–211170/6/XAB) **Y-Si-Al-O-N glass fibers. Final report.** Messier, D.R.; Gleisner, R.P.; Rich, R.E. Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab. May 1989. 17p. (MTL-TR–89-44). Available from NTIS, PC A03/MF A01.

The excellent mechanical properties and outstanding water corrosion resistance of Y-Si-Al-O-N glasses indicate that they are attractive candidate materials for forming into high-performance glass fibers. Fibers of glasses containing, respectively, 3.2 and 6.6 wt% N were drawn freehand in air, and from glass rods in N2. Continuous fibers (100-m long) of the former glass were melt-drawn in N2 while being wound in air outside of the glass-melting furnace. Some fibers had diameters as small as 10 um, and characterization data show that the fibers retain all of the desirable properties of the bulk glass.

2968 (CONF-880810–2) **Standard molar enthalpies of formation and transition at 298.15 K and other thermodynamic properties of the crystalline and vitreous forms of arsenic sesquiselenide (As_2Se_3): Dissociation enthalpies of As-Se bonds.** O'Hare, P.A.G.; Lewis, B.M.; Susman, S.; Volin, K.J. Argonne National Lab., IL (USA). [1988]. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8809198–1: 10. IUPAC conference on chemical thermodynamics; 4. Polish conference on calorimetry and thermal analysis, Prague (Czechoslovakia); Warsaw (Poland), 29 Aug - 2 sep 1988; 4-10 sep 19). Order Number DE90002260. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fluorine-combustion calorimetry was used to determine the standard molar enthalpies of formation (at 298.15 K and p^0 = 101.325 kPa) of the crystalline and vitreous forms of arsenic sesquiselenide. The following results were obtained: $\Delta_f H_m^0(As_2Se_3, cr) = -(86.1 \pm 4.1)$ kJ·mol^{-1} and $\Delta_f H_m^0(As_2Se_3, vit) = -(58.1 \pm 4.2)$ kJ·mol^{-1}. The enthalpy of the transition from the vitreous to the crystalline forms of As_2Se_3, $-(28.0 \pm 3.9)$ kJ·mol^{-1} at 298.15 K, supports two of several published values for the enthalpy of fusion of the crystalline sesquiselenide. The present results have been combined with enthalpy increments and the standard entropy recalculated from the literature to give, for As_2Se_3(cr) only, $\Delta_f H_m^0$ and the standard molar Gibbs energy of formation $\Delta_f G_m^0$ as functions of temperature. Mean bond enthalpies have been deduced for As_4Se_3(g) and As_4Se_4(g) on the basis of the new $\Delta_f H_m^0$ values, and the thermodynamic results are shown to be consistent with a linear structure for As_2Se_2(g). Bond dissociation enthalpies D_m^0(As–X) are given, where X = O, S, Se, and Te. 47 refs., 1 fig., 4 tabs.

2969 (CONF-8908179–2) **Maximum entropy and equations of state for random cellular structures.** Rivier, N. Argonne National Lab., IL (USA). 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Conference on maximum entropy and bayesian methods; Hanover, NH (USA); 14-18 Aug 1989. Order Number DE90002840. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Random, space-filling cellular structures (biological tissues, metallurgical grain aggregates, foams, etc.) are investigated. Maximum entropy inference under a few constraints yields structural equations of state, relating the size of cells to their topological shape. These relations are known empirically as Lewis's law in Botany, or Desch's relation in Metallurgy. Here, the functional form of the constraints is now known as a priori, and one takes advantage of this arbitrariness to increase the entropy further. The resulting structural equations of state are independent of priors, they are measurable experimentally and constitute therefore a direct test for the applicability of MaxEnt inference (given that the structure is in statistical equilibrium, a fact which can be tested by another simple relation (Aboav's law)). 23 refs., 2 figs., 1 tab.

2970 (DOE/ER/13732–2) **Synthesis and properties of new preceramic materials: Research progress report, December 1, 1988–November 30, 1989.** Sneddon, L.G. Pennsylvania Univ., Philadelphia, PA (USA). Sep 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13732. Order Number DE90002562. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The development of new methods for the production of complex materials is one of the most important problems in modern solid state chemistry and materials science. This project is attempting to apply the synthetic principles which have evolved in inorganic and organometallic chemistry to the production of important non-oxide ceramics, such as boron nitride, boron carbide and metal borides. Our recent work has now resulted in the production of several new polymer systems, including poly(vinylborazine), poly(vinylpentaborane) and poly(borazylene), that have proven to be high yield precursors to boron nitride and/or boron carbide. Current work is now directed toward the synthesis of new types of molecular and polymeric boron-containing species and an exploration of the solid state properties of the ceramics that have been produced in these studies.

2971 (INIS-BR–1766) **Fluorescence and optical absorption in spodumene.** Antonini, R. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. 1987. 101p. (In Portuguese). Order Number DE90608107. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

This work studied the mechanism of the isothermal decay's kinetic of the 15.600 cm-1 optical absorption band (A.O.) of irradiated spodumene, and the phosphorescence of irradiated spodumene in low temperatures. The kinetic mechanisms applying the bimolecular model to liberation, capture and recombination reactions are analysed. The coupled differential equations, resultants of this model, numerically using the Runge-Kutta method is solved, and a computer programs that allowed determine the kinetics parameters by try and error methods is developped. This work showed that the electrons are untrapped according to Arrhernios kinetic and that the parameters of the trap and recombination are proportional to a factor ($\sqrt{T} - \sqrt{T_o}$), where T_o is the cutting temperature, bfore which the reactions do not occur. (author).

2972 (JAERI-M–89-096) **Gamma-ray irradiation effects of poly(ethylene-2, 6-naphthalate) and poly(ethylene-terephthalate).** Saito, Toshio; Seguchi, Tadao; Nagano, Shosaburo; Omae, Iwao. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1989. 34p. (In Japanese). Order Number DE90719605. Available from NTIS (US Sales Only), PC A03/MF A01.

The irradiation effects and radiation resistances of poly(ethylene-2, 6-naphthalate) (PEN) and poly(ethylene-terephthalate)(PET) were investigated by the analyses of evolved gases, crosslinking and chain scission, and physical properties of thermal behavior and tensile strength after irradiation by gamma-rays under vacuum and in oxygen atmosphere. The evolved gases in both PEN and PET were mainly CO_2 and small amounts of H_2, CH_4, and CO. The G-values of CO_2 were 0.004 for PEN and 0.07 for PET by irradiation under vacuum, and were 0.26 for PEN and 0.17 for PET in oxygen. In the case of irradiation without oxidation, the crosslinking proceeded mainly for PEN, but the chain scission was the main reaction for PET. In the case of oxidative irradiation, the chain scission proceeded and no cross-linking was observed for both PEN and PET. The change of mechanical properties of PEN film irradiated under vacuum was very small by comparing with PET. The radiation resistances of PEN and PET were evaluated to be 12 MGy for PEN and 2 MGy for PET in non-oxidative conditions, and were 4.5 MGy for PEN and 1.4 MGy for PET in oxidation conditions by the measurements of tensile testing. The reason of high radiation resistance of PEN was thought that PEN molecules have a large resonance energy of napthalene in the polymer chain, and have higher probability of crosslinking comparing with PET molecules due to the molecular conformation such as crystalline structure. (author).

2973 (N–89-26918) **Fracture toughness of SIC/Al metal matrix composite.** Flom, Y.; Parker, B.H.; Chu, H.P. National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center. Aug 1989. 18p. (NASA-TM–100745;NAS–1.15:100745;REPT–89B00215;CONF-8909260–: 21. international conference of the Society for the Advancement of Materials and Process Engineering (SAMPE), Atlantic City, NJ (USA), 25-28 Sep 1989). Available from NTIS, PC A03/MF A01.

An experimental study was conducted to evaluate fracture toughness of SiC/Al metal matrix composite (MMC). The material was a 12.7 mm thick extrusion of 6061-T6 aluminum alloy with 40 v/o SiC particulates. Specimen configuration and test procedure conformed to ASTM E399 Standard for compact specimens. It was found that special procedures were necessary to obtain fatigue cracks of controlled lengths in the preparation of precracked specimens for the MMC material. Fatigue loading with both minimum and maximum loads in compression was used to start the precrack. The initial precracking would stop by self-arrest. Afterwards, the precrack could be safely extended to the desired length by additional cyclic tensile loading. Test results met practically all the E399 criteria for the calculation of plane strain fracture toughness of the material. A valid K_{IC} value of the SiC/Al composite was established as K_{IC} = 8.9 MPa square root of m. The threshold stress intensity under which crack would cease to grow in the material was estimated as delta K sub th = 2MPa square root of m for R = 0.09 using the fatigue precracking data. Fractographic examinations show that failure occurred by the micromechanism involved with plastic deformation

although the specimens broke by brittle fracture. The effect of precracking by cyclic loading in compression on fracture toughness is included in the discussion.

2974 (N–89-26989) **Fatigue crack growth study of SCS6/Ti-15-3 composite.** Kantzos, P.; Telesman, J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Aug 1989. 20p. (NASA-TM–102332;E–5041;NAS–1.15:102332). Available from NTIS, PC A03/MF A01.

A study was performed to determine the fatigue crack growth (FCG) behavior and the associated fatigue damage processes in a (0)(8) and (90)(8) oriented SCS(6)/Ti-15-3 composite. Companion testing (CT) was also done on identically processed Ti-15-3 unreinforced material. The active fatigue crack growth failure processes were very similar for both composite orientations tested. For both orientations, fatigue crack growth was along the fiber direction. It was found that the composite constituent most susceptible to fatigue damage was the interface region and in particular the carbon coating surrounding the fiber. The failure of the interface region lead to crack initiation and also strongly influenced the FCG behavior in this composite. The failure of the interface region was apparently driven by normal stresses perpendicular to the fiber direction. The FCG rates were considerably higher for the (90)(8) oriented CT specimens in comparison to the unreinforced material. This is consistent with the scenario in which the interface has lower fatigue resistance than the matrix, causing lower composite fatigue resistance. The FCG rates of the (0)(8) composite could not be directly compared to the (90)(8) composite but were shown to increase with an increase in the crack length.

2975 (N–89-27223) **Optimum interface properties for metal matrix composites.** Ghosn, L. J.; Lerch, B. A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Aug 1989. 21p. (NASA-TM–102295;E–4964;NAS–1.15:102295). Available from NTIS, PC A03/MF A01.

Due to the thermal expansion coefficient mismatch (CTE) between the fiber and the matrix, high residual sresses exist in metal matrix composite systems upon cool down from processing temperature to room temperature. An interface material can be placed between the fiber and the matrix to reduce the high tensile residual stresses in the matrix. A computer program was written to minimize the residual stress in the matrix subject to the interface material properties. The decision variables are the interface modulus, thickness and thermal expansion coefficient. The properties of the interface material are optimized such that the average distortion energy in the matrix and the interface is minimized. As a result, the only active variable is the thermal expansion coefficient. The optimum modulus of the interface is always the minimum allowable value and the interface thickness is always the maximum allowable value, independent of the fiber/matrix system. The optimum interface thermal expansion coefficient is always between the values of the fiber and the matrix. Using this analysis, a survey of materials was conducted for use as fiber coatings in some specific composite systems.

2976 (N–89-27795) **Computational simulation of high temperature metal matrix composites cyclic behavior.** Chamis, C. C.; Murthy, P. L. N.; Hopkins, D. A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Nov 1988. 15p. (NASA-TM–102115;E–4888;NAS–1.15:102115;CONF-8811285–: ASTM symposium on thermal and mechanical behavior of ceramic and metal matrix composites, Atlanta, GA (USA), 7-8 Nov 1988). Available from NTIS, PC A03/MF A01.

A procedure was developed and is described which can be used to computationally simulate the cyclic behavior of high temperature metal matrix composites (HTMMC) and its degradation effects on the structural response. This procedure consists of HTMMC mechanics coupled with a multifactor interaction constituent material relationship and with an incremental iterative nonlinear analysis. The procedure is implemented in a computer code that can be used to computationally simulate the thermomechanical behavior of HTMMC starting from the fabrication process and proceeding through thermomechanical cycling, accounting for the interface/interphase region. Results show that combined thermal/mechanical cycling, the interphase, and in situ matrix properties have significant effects on the structural integrity of HTMMC.

2977 (N–89-28035) **Research and technology plans for FY 1989 and accomplishments for FY 1988.** Bales, K.S. National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center. Apr 1989. 95p. (NASA-TM–101592;NAS–1.15:101592). Available from NTIS, PC A05/MF A01.

The Objectives, FY 1989 Plans, Approach, and FY 1989 Milestones for the Structural Mechanics Division's research programs are presented. Fiscal year 1988 Accomplishments are presented where applicable. This information is useful in program coordination with other governmental organizations in areas of mutual interest.

2978 (ND-R–1065(S)) **Detection of fine pore structures in graphite by impregnation with Wood's metal.** Morris, F.W.; Schofield, P.; Whitty, S. UKAEA Northern Research Labs., Risley (UK). Oct 1988. 15p. Available from H.M. Stationery Office, London, price Pound 8.50.

A method is described for the high pressure impregnation of graphite with Wood's Metal leading to the filling of pore sections as narrow as 0.1 μm. The method allows high resolution, high contrast imaging of graphitic pore structures in the scanning electron microscope with subsequent automatic image analysis. The choice of operating parameters for the scanning examination and during image analysis is explained. (author).

2979 (ORNL/FTR–3089) **[Graphite and carbon/carbon composition]: Foreign trip report, September 17, 1988–September 28, 1988.** Eatherly, W.P. Oak Ridge National Lab., TN (USA). 20 Oct 1988. 18p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001303. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report covers the author's attendance at the international conference, CARBON '88, held at the University of Newcastle upon Tyne, on September 18–23, 1988, and ancillary program planning meetings held at Newcastle, United Kingdom (UK), and Juelich, Federal Republic of Germany (FRG). The conference presented two half-day sessions on nuclear applications of graphite which were well attended by people with both fission and fusion interests. This author presented two papers containing work to which C. R. Kennedy of Oak Ridge National Laboratory (ORNL) had been a major contributor. One paper provides an empirical correlation between graphite creep and dimensional changes; the other describes dimensional behavior of an anisotropic graphite used in the N Reactor at Richland, Washington.

2980 (PB–89-208235/XAB) **Applicability of the DMSO (dimethyl sulfoxide) aggregate degradation test to determine moisture-induced distress in asphalt-concrete mixes. Final report, June 1986-June 1987.** Heinicke, J.J.; Vinson, T.S.; Wilson, J.E. Oregon State Univ., Corvallis, OR (USA). Transportation Research Inst. Jun 1987. 99p. (TRR–87-26). Available from NTIS, PC A05/MF A01.

A laboratory investigation was conducted to evaluate the effectiveness of the dimethyl sulfoxide accelerated weathering test (DMSO test) to predict moisture-induced distress in asphalt-concrete mixtures. Asphalt-concrete specimens were fabricated using aggregates from three quarries. The specimens were conditioned using vacuum saturation and a series of five freeze/thaw cycles. The resilient modulus (M_r) was obtained before and after each conditioning cycle and the Index of Retained Resilient Modulus (IRM_r) was determined. The results indicate the DMSO test may be used to identify the potential for moisture-induced distress in asphalt-concrete mixtures. However, no correlation was determined between the DMSO test results and the IRM_r or fatigue life test results. The strain and temperature dependencies of the M_r were determined for a dense-graded asphalt-concrete mixture. It was concluded that constant stress testing may result in a misinterpretation of the IRM_r and tests conducted within the currently accepted temperature range may result in a plus or minus 20% deviation in the IRM_r. In an accompanying analytical program, the effect of diametral test boundary conditions on the measured value of M_r was evaluated using two- and three-dimensional finite element models. The results indicate that the resilient modulus diametral test is adequately represented by elastic theory and an assumed plane stress condition.

2981 (PB–89-870612/XAB) **Plastics and elastomers: Radiation crosslinking. April 1986-September 1989 (Citations from**

the Rubber and Plastics Research Association data base). Report for April 1986-September 1989. National Technical Information Service, Springfield, VA (USA). Sep 1989. 77p. Available from NTISPC N01/MF N01.

Supersedes PB–88-869458. See also PB–89-870927.

This bibliography contains citations concerning radiation cross-linking processes for plastics and elastomers. Radiation sources and manufacturing processes are discussed, and the molecular structure and mechanical properties of the polymers are considered. Applications for paints, varnishes, adhesives, inks, and insulating coatings are presented. (This updated bibliography contains 114 citations, 32 of which are new entries to the previous edition.)

2982 (PB–89-871107/XAB) **Fire-extinguishing agents. January 1970-September 1989 (Citations from the COMPENDEX data base). Report for January 1970-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 74p. Available from NTISPC N01/MF N01.

Supersedes PB–83-805499.

This bibliography contains citations concerning fire-extinguishing agents including foams, aqueous films, dry chemicals, fly ash, inert gases, and halogenated compounds. Performance characteristics, interaction mechanisms, and properties of these agents are examined. Applications in building fires, shipboard fires, mining, aircraft, automobile fires, and industrial chemical fires are presented. Fire detection and alarm systems are examined in a separate bibliography. (This updated bibliography contains 181 citations, 75 of which are new entries to the previous edition.)

2983 (PPA-T–82) **Synthesis of acrylic prepolymer.** Hussin bin Mohd Nor; Dahlan bin Haji Mohd; Mohamad Hilmi bin Mahmood. Unit Tenaga Nuklear, Bangi, Selangor (Malaysia). Apr 1988. 12p. Order Number DE90608085. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

An acrylic prepolymer was synthesized from glycidyl methacrylate (GMA), butyl methacrylate (BMA), methyl methacrylate (MMA) and acrylic acid (AA). Butyl acetate (BAc), benzoyl peroxide (BzO), 4-methoxyphenol (MPh) and triethylamine (TEA) were used as solvent, initiator, inhibitor and catalyst respectively. Observations of the synthesis leading to the formation of acrylic prepolymer are described. (author).

2984 (PPA-T–86) **Synthesis of epoxidised soya bean oil acrylate.** Hussin bin Mohd Nor; Mohamad Hilmi bin Mahmood; Dahlan bin Haji Mohd. Unit Tenaga Nuklear, Bangi, Selangor (Malaysia). Oct 1988. 10p. Order Number DE90608086. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

An epoxy acrylate was synthesized from Asahi's epoxy resin AER 331 which is an epoxidised soya bean oil (ESBO). Triethylamine (TEA) and Hydroquinone (HQ) were used as catalyst and inhibitor respectively. Observations of the experiment are described. (author).

2985 (RFP–4377) **Hydrogen permeability coefficient determinations for used waste drum liners.** McFeeters, T.L. Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. Oct 1989. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP03533. Order Number DE90002233. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Hydrogen permeability coefficients were determined for samples of drum liner materials (polyvinylchloride and polyethylene bags) from stored drums of radioactive waste. The hydrogen permeability coefficients were determined by dynamic mass spectrometry, and are quantitatively traceable to the National Bureau of Standards. This report presents the analytical results obtained and a brief discussion of the analytical experimentation. Since sample variables (drum storage time and conditions, radioactive flux, material surface contamination, etc.) are potential factors and are not available here for correlation with permeability results, no interpretative discussion of these factors is included in this report. 3 figs., 1 tab.

2986 (UCRL–98583) **Gels and foams from ultrahigh molecular weight polyethylene.** Hair, L.M.; Letts, S.A.; Tillotson, T. Lawrence Livermore National Lab., CA (USA). Jul 1988. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-880912–34: 196. American Chemical Society national meeting, Los Angeles, CA (USA), 25-30 Sep 1988). Order Number DE90001896. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ultrahigh molecular weight polyethylene (UHMW PE) foams with densities from 0.04 to 0.2 g/cm^3 have routinely been made in our laboratory. First, an entangled solution of UHMW PE is made. Then, the solution is geled by cooling to crystallize the PE. The gel is later dried to a foam by critical point drying. Viscometry and cloud point measurements were used to determine the gelatin point and the critical gelatin concentrations. Polarized light microscopy and differential scanning calorimetry were used to investigate the effects of cooling rate on the gel, while the effects of cooling rate on the foam were investigated via x-ray diffraction and scanning electron microscopy. We found that rapid cooling of 5 wt % UHMW PE/tetralin solutions to −10°c yielded small, uniform structure at the expense of crystallinity and strength; cooling over three days yielded spherulitic structure with strength. 5 refs., 3 figs.

2987 (UCRL–98656) **Studies of polymer foam morphology with FIR [far-infrared radiation] laser scattering.** Hrubesh, L.W.; Staffin, R.; Boercker, D.B.; Wainright, T. Lawrence Livermore National Lab., CA (USA). Apr 1988. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-880870–4: 4. international conference on infrared physics, Zurich (Switzerland), 22-26 Aug 1988). Order Number DE90002235. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We report on the experimental observation of peaks in the angular distribution of far-infrared radiation scattered from solid, low density polymer foams. The results are consistent with a description of scattering from density fluctuations within the foams. 3 refs., 1 fig.

2988 (UCRL–102028) **Challenges in processing for polymer composites.** Chiao, L.; Chiao, T.T. Lawrence Livermore National Lab., CA (USA). 13 Sep 1989. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910290–1: 36. Sagamore conference on thick section composites, Plymouth, MA (USA), 23-26 Oct 1989). Order Number DE90002224. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Processing technology is considered to be the key for future cost and performance improvement in fiber composite structures. The challenges are discussed in two broad areas: Engineering and research. In engineering, the challenge is to reduce cost while maintaining the state-of-the-art quality of composite structures. This can be done through innovative process development work. In research, the challenge is to concentrate on processing science. We need to reexamine and focus on basic issues such as voids, fiber wetting and filament/tow collimation, fiber/resin ratio, uniform fiber distribution and cure effects. These issues, combined and interactive in a laminate, have created many confusing topics such as "composite toughness", low transverse failure strain and poor compression properties. To date, processing technology is considered the weak link in the chain of a fiber composite system, which also includes good design practices and proper material selections. This is because process studies in composites have traditionally been considered mundane by many researchers; furthermore, this type of work is very difficult to do in universities. We strongly believe, however, that the highest potential for cost reduction for composites is clearly in processing technology. Also, process improvement technology may often be an easier option than the materials modification approach, to resolving many of the longstanding and confusing issues in the field of fiber composites. 12 refs., 13 figs., 2 tabs.

2989 Electron microscopy study of morphology and composition of a ferrisilicate catalyst. Csencsits, R. (Center for Advanced Materials, Materials and Chemical Sciences Div., Lawrence Berkeley Lab., and Materials Science and Mineral Engineering Dept., Univ. of California, Berkeley, CA (US)); Gronsky, R.; Nair, V.; Szostak, R. vp of Microstructure and properties of catalysts. Treach, M.M.J.; Thomas, J.M.; White, J.M. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC03-76SF00098;AC22-86PC90007. (CONF-8711205–: Symposium on microstructure and properties of catalysts, Boston, MA (USA), 30 Nov - 3 dec 1987).

In this paper the effects of various synthesis conditions on the structure and composition of ferrisilicate analogs of zeolite ZSM-5 are considered. Scanning electron microscopy (SEM) was used to

determine the particles size distributions and morphologies. Particle sizes vary from tenths of a micron to several microns, depending on degree of agitation during crystal growth, while morphology is additionally dependent on the concentration of iron in the gel during crystallization. X-ray emissive spectroscopy (XES) performed in the transmission electron microscopy (TEM) was used to determine their composition variation. The distribution of iron amongst the crystals is described.

2990 Enhanced oxidation of $TiSi_2$ films by As^+ implantation. Holland, O.W. (Oak Ridge National Lab., Oak Ridge, TN (US)); Fathy, D. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC05-84OR21400. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

In this paper the influence of As^+-ion implantation on the oxidation of $TiSi_2$ films is investigated. It is shown that implantation leads to a greatly increased rate of oxidation in a dry O_2 ambient. Low-temperature oxidation of the implanted films not only results in substantial oxidation of the films, but completely alters the films' morphology. Different implantation techniques were used. It is shown that neither chemical nor damage effects are able, by themselves, to account for the enhanced oxidation. A model is proposed to explain the role of implantation in the oxidation process.

2991 In situ tem observations of heavy ion damage in gallium arsenide. Bench, M.W. (Univ. of Illinois, Urbana, IL (US)); Robertson, I.M.; Kirk, M.A. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-31109-ENG-38. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper discusses transmission electron microscopy experiments performed to investigate the lattice damage created by heavy-ion bombardments in GaAs. These experiments have been performed in situ by using the HVEM - Ion. Accelerator Facility at Argonne National Laboratory. Direct-impact amorphization is observed to occur in both n-type and semi-insulating GaAs irradiated to low ion doses at 30 K and room temperature. The probability of forming a visible defect is higher for low temperature irradiations than for room temperature irradiations.

2992 Structural studies of pillared clays and modified pillared clays. Carrado, K.A. (Chemistry Div., Argonne National Lab., 9700 South Cass Avenue, Argonne, IL (US)); Thompson, A.R.; Winans, R.E.; Botto, R.E. vp of Microstructure and properties of catalysts. Treach, M.M.J.; Thomas, J.M.; White, J.M. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-31-109-ENG-38. (CONF-8711205–: Symposium on microstructure and properties of catalysts, Boston, MA (USA), 30 Nov - 3 dec 1987).

In this paper the long-range order of pillared interlayered clays (PILCs) after acid activation with 0.05N HCl is investigated by X-ray diffraction (XRD) methods. The data show that long-range order in PILCs decreases as AlCH-PB = ZrCH-PB >> Zr/AlCH-PB = Cr/AlCH-PB (PB = pillared bentonite; MCH = metal chlorohydroxy pillaring agent, where M = Al, Zr or Cr). Apparently, pure oxide clusters are more stable than mixed oxide clusters. Treatment of PILCs with dilute HCl at 25^0C is less damaging than at reflux temperature, and calcined PILCs are more stable than air-dried materials.

2993 A new polymer-based hydrogen getter. Gilliom, L.R. (Sandia National Labs., Div. 1811, Albuquerque, NM (US)). vp of Microstructure and properties of catalysts. Treach, M.M.J.; Thomas, J.M.; White, J.M. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711205–: Symposium on microstructure and properties of catalysts, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes styrene-butadiene triblock copolymer PS-PB-PS hydrogenated in the bulk using the Crabtree catalyst [Ir(COD) (py) (tcyp)]PF_6 (COD = 1,5-cyclooctadiene, py = pyridene, tcyp = tricyclohexylphosphine). Since this polymer/catalyst mixture reacts rapidly with hydrogen at ambient temperature and low hydrogen pressures, it should act as an effective hydrogen getter.

2994 High energy ion beam annealing in implanted CdTe. Withrow, S.P. (Oak Ridge National Lab., Oak Ridge, TN (US)); Lusnikov, A.; Jimenez-Gonzalez, H.; Dresselhaus, G. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC05-84OR21400;AC05-76OR00033. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

In this paper the annealing effects of a high energy beam of Cu ions on implanted CdTe crystals are studied. Single crystals of CdTe have been implanted with Eu (energy 60 keV, fluence 1×10^{16} cm^{-2}) at substrate temperatures of 25^0C, and 400^0C. Lattice damage introduced by the implantation process was measured by Rutherford backscattering. The samples were then implanted with high energy Cu ions (energy 3.5 MeV, fluence 0.5×10^{16} cm^{-2}) at substrate temperatures of 25^0C and 200^0C. Channeling spectra from these samples indicate a reduction in the near-surface lattice damage as a result of the Cu implantation that can be unambiguously separated from the external heating of the substrate.

2995 Time-resolved reflectivity measurement of the pressure-enhanced crystallization rate of amorphous Si in a diamond anvil cell. Lu, G.Q. (Harvard Univ., Cambridge, MA (US)); Nygren, E.; Turnbull, D.; Aziz, M.J. vp of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

The authors have measured the pressure dependence of the solid phase epitaxial growth (SPEG) rate of self-implanted Si(100) by using the in-situ time-resolved reflectivity technique in a high-temperature and high-pressure diamond anvil cell (DAC). With fluid argon as the pressure transmission medium, a clean and perfectly hydrostatic pressure environment is achieved around the sample. The implications of results for the nature of the defect responsible for thermal SPEG and irradiation enhanced SPEG is discussed.

2996 Recrystallization characteristics of amorphous Si. Herring, R.A. (Martin Marietta Labs., Baltimore, MD (US)); Fiore, E.M. vp of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper discusses the microstructure of high-energy (0.5-6.0 MEV) As-ion implanted Si and rapid thermal annealed (RTA'd) Si studied by transmission electron microscopy (TEM). The implantations formed buried amorphous layers that recrystallized during RTA at different temperatures and became either single crystal or polycrystalline depending on their implantation energy and fluence. The results are explained by both the formation mechanisms of amorphous Si resulting from ion implantation and the structural order of a-Si.

2997 Precipitation, phase transformation, and enhanced diffusion in ion-implanted silicon. Pennycook, S.J. (Oak Ridge National Lab., Oak Ridge, TN (US)); Culbertson, R.J.; Berger, S.D. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC05-84OR21400. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes Z-contrast scanning transmission electron microscopy used to study the connection between dopant precipitation and phase transformation in high dose In^+ and Sb^+ implanted Si. In the case of In, the observations confirm a heterogeneous nucleation model. Images of the precursor precipitates give the first measurement of the diffusion coefficient in amorphous Si, with an enhancement of 10^7 over tracer crystalline values. With Sb^+ implants enhanced homogeneous nucleation is observed. The connection between these results and the transient enhanced diffusion observed in crystallized Si is discussed.

2998 Supercooling of silicon and germanium after laser melting. Stiffler, S.R. (Cornell Univ., Ithaca, NY (US)); Thompson, M.O.; Peercy, P.S. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

Following pulsed laser melting, supercoolings of 505 K in Si and 430 K in Ge were observed prior to bulk nucleation. These large supercoolings are obtained because of the extremely high thermal quench which follows laser irradiation. In this paper nucleation rates are estimated. Assuming that homogeneous nucleation was achieved, surface energies are also reasonable agreement with traditional homogeneous nucleation experiments. This laser melting technique is applicable to nucleation studies in a wide variety of materials.

2999 Interface temperatures and temperature gradients in silicon during pulsed laser irradiation. Larson, B.C. (Oak Ridge National Lab., Oak Ridge, TN (US)); Tischler, J.Z.; Mills, D.M. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC05-84OR21400. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

Nanosecond-resolution x-ray diffraction has been used to measure the interface and lattice temperatures of silicon during rapid, pulsed-laser induced melting and regrowth in silicon. Measurements have been carried out on <100> and <111> oriented silicon using the (100) and (111) reflections to measure the thermal strain during 30 ns, 1.1 J/cm^2 KrF laser pulses. The results are discussed in this paper. Observations of higher than expected temperature gradients below the liquid-solid interface are discussed in terms of restricted heat flow under high gradients.

3000 Interface velocity transients during melting of a-Si/c-Si thin films. Tsao, J.Y. (Sandia National Labs., Albuquerque, NM (US)); Peercy, P.S.; Aziz, M.J.; Thompson, M.O. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

The authors report transient conductance measurements of liquid/solid interface velocities during pulsed laser melting of amorphous Si (a-Si) films on crystalline Si (c-Si), and a more accurate, systematic procedure for analyzing these measurements than described in previous work. From these analyses are extracted relations between the melting velocities of a-Si and c-Si at a given interface temperature, and between the temperature during steady-state melting of a-Si and c-Si at a given interface velocity.

3001 Ion beam modification of film stress and the effectiveness of thin film encapsulants on GaAs. Haynes, T.E. (Univ. of North Carolina, Chapel Hill, NC (US)); Chu, W.K.; Picraux, S.T. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes an ion implantation to modify the initial stress in thin (40 nm) SiO_2 films on GaAs, and to condition the SiO_2-GaAs interface to promote adhesion. The effectiveness of these implanted films as caps to suppress decomposition of GaAs during rapid thermal processing has been studied, and this provides an indicator of the mechanical stability of the films. Measurements of the initial film stress, as well as stress change caused by implantation and annealing, have been made to help interpret the implantation results.

3002 Molecular dynamics of laser ablation of a polymer coating. Noid, D.W. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831 (US)); Gray, S.K. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 756-760 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

Large-scale molecular dynamics calculations have been carried out to simulate laser ablation on a polymer surface. The model consisted of a polyethylene chain with 400 CH_2 units placed on a polymer surface. A laser excitation was simulated by giving a small portion of the polymer chain a nonequilibrium momentum distribution. The excitation energy threshold for fragmentation of the polymers was found to be quite large, owing to the tendency of the system to transfer large amounts of vibrational energy along the chain.

3003 Adsorption of NO on diamond C(111)-(2×1) by band-gap excitation. Hamza, A.V. (Sandia National Laboratories, Livermore, California 94551 (US)); Kubiak, G.D. *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena (USA),* 7(5): 1165-1170 (Sep 1989).

Band-gap excitation promoted the adsorption of nitric oxide on diamond C(111)-(2×1). In the absence of laser excitation the sticking probability for NO was $\sim 10^{-8}$. Laser excitation of the surface at 226 nm, with a duty cycle of 10^{-7}, significantly enhanced the adsorption of NO. The time-averaged reactive sticking probability for the laser-irradiated surface increased by more than a factor of 100. However, the reaction saturated at ~1.2% of a monolayer oxygen adatom coverage, indicative of adsorption mediated by defect sites. Similar behavior was observed on the diamond C(100)-(1×1) surface. Translational activation of the adsorption of NO was also observed. The adsorption probability for NO accelerated to ~280 meV by supersonic molecular-beam techniques was $\sim 6 \times 10^{-4}$ for the diamond C(111)-(2×1) surface, but again chemisorption saturated at ~1.6% of a monolayer O adatom coverage.

3004 Anisotropic thermionic emission of electrons contained in GaAs/AlAs floating gate device structures. Lott, J.A. (Sandia National Laboratories, Division 1141, Albuquerque, New Mexico 87185 (US)); Klem, J.F.; Weaver, H.T. *Applied Physics Letters (USA),* 55(12): 1226-1228 (18 Sep 1989). DOE Contract AC04-76DP00789.

Thermionic emission rates are reported for electrons in GaAs epilayers, where electrostatic barriers within the layers and GaAs/AlAs heterojunctions form different sides of the potential well. Attempt times at the two barrier types were observed to differ by factors above 10^7 due to differing constraints on momentum conservation during emission. These emissions represent escape mechanisms for charge stored in a closed geometry, III-V compound floating gate transistor, with potential application as dynamic random access or nonvolatile memories.

3005 Ultralow recombination velocity at $Ga_{0.5}In_{0.5}P$/GaAs heterointerfaces. Olson, J.M. (Solar Energy Research Institute, Golden, Colorado 80401 (US)); Ahrenkiel, R.K.; Dunlavy, D.J.; Keyes, B.; Kibbler, A.E. *Applied Physics Letters (USA),* 55(12): 1208-1210 (18 Sep 1989).

Using time-resolved photoluminescence, we have examined the optoelectronic properties of $Ga_{0.5}In_{0.5}P$/GaAs/$Ga_{0.5}In_{0.5}P$ double heterostructures grown by organometallic chemical vapor deposition. For comparison, similar structures using $Al_{0.4}Ga_{0.6}As$/GaAs and $Al_{0.5}In_{0.5}P$/GaAs lattice-matched heterointerfaces were also examined. For the $Ga_{0.5}In_{0.5}P$/GaAs heterostructure, we show that the recombination velocity at a $Ga_{0.5}In_{0.5}P$/GaAs interface can be less than 1.5 cm/s. As a result, photoluminescence decay times as long as 14 μs have been observed in undoped GaAs double heterostructures. This photoluminescence decay time varies with temperature as $T^{1.50}$, characteristic of radiative recombination not limited by surface or bulk nonradiative recombination processes. For the $Al_{0.4}Ga_{0.6}As$/GaAs and $Al_{0.5}In_{0.5}P$/GaAs heterostructures examined in this study, the upper limits of the interface recombination velocity were 210 and 900 cm/s, respectively.

3006 Structure determination of the Si(111):B($\sqrt{3}\times\sqrt{3}$)$R30°$ surface: Subsurface substitutional doping. Headrick, R.L. (AT&T Bell Laboratories, Murray Hill, New Jersey 07974 (US)); Robinson, I.K.; Vlieg, E.; Feldman, L.C. *Physical Review Letters (USA)*, 63(12): 1253-1256 (18 Sep 1989).

Synchrotron x-ray diffraction has been used to analyze the ($\sqrt{3}\times\sqrt{3}$)$R30°$ reconstruction of B/Si(111). Excellent agreement is obtained with in-plane data for a model in which boron sits in every third site of threefold symmetry. Out-of-plane diffraction, however, is only consistent with boron *below* the surface in the fivefold-coordinated substitutional site under a silicon T_4 adatom. The structure is confirmed by the growth behavior under room-temperature Si deposition in which the silicon adatom is displaced from its ordered site leaving boron in a two-dimensional ordered substitutional array.

3007 Band bending and oxygen-induced defects in *a*-Si:H. Winer, K. (Xerox Palo Alto Research Center, Palo Alto, California 94304 (US)). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena (USA)*, 7(5): 1226-1231 (Sep 1989).

Total yield photoelectron spectroscopy and Kelvin probe measurements are used to monitor the adsorption of activated oxygen onto clean hydrogenated amorphous silicon (*a*-Si:H) surfaces at submonolayer coverages. Oxygen adsorption induces up to 3×10^{12} cm^{-2} occupied near-surface gap states in a band centered 5.15 eV below the vacuum level and results in an 0.25-eV downward band bending at both slightly *n*-type and intrinsic *a*-Si:H surfaces. It is proposed that the downward band bending is due to the transfer of electrons from overcoordinated surface oxygen atoms to neutral defects native to *a*-Si:H, which form negatively charged deep states in a near-surface accumulation layer. The surface donor character of adsorbed oxygen is contrary to its usual strong electronegativity but is analogous to the donor character of overcoordinated phosphorus atoms in the *a*-Si:H bulk, which also lead to the creation of negatively charged deep states. Doping and deep defect formation in *a*-Si:H are discussed.

3008 Electric field response of a semiconductor superlattice optical mirror from electroreflectance spectra. Fritz, I.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)); Gourley, P.L.; Drummond, T.J. *Applied Physics Letters (USA)*, 55(13): 1324-1326 (25 Sep 1989). DOE Contract AC04-76DP00789.

We report low-field electroreflectance (ER) spectra of an all-semiconductor multilayer optical mirror structure. The structure, consisting of alternating blocks of AlAs/$Al_{0.5}Ga_{0.5}$ As and $Al_{0.5}Ga_{0.5}$As/GaAs multiple quantum well layers, was grown by molecular beam epitaxy without wafer rotation. Thickness variations across the wafer produce a position-dependent reflectance spectrum. The observed line shape of the band-edge exciton depends on its wavelength position relative to the mirror spectrum and cannot be explained by ordinary ER theory, due to the rapidly varying background mirror reflectance. Computer simulations, using the matrix method to calculate the reflectance for different layer thicknesses and exciton energies, agree qualitatively with the data. A strong enhancement in ER response is predicted near the minima in the mirror spectrum. This enhancement is important in electo-optic reflectance modulators.

3009 Scaling relations for strained-layer relaxation. Dodson, B.W. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)); Tsao, J.Y. *Applied Physics Letters (USA)*, 55(13): 1345-1347 (25 Sep 1989). DOE Contract AC04-76DP00789.

Scaling relations for relaxation in strained-layer structures, based on simple descriptions of the dominant relaxation mechanisms and the influence of a stress-dependent relaxation activation energy, are obtained for general III-V semiconductor alloys. As a result, strained-layer relaxation in a given material system can be predicted over a wide range of structural parameters and temperature history based on a single relaxation measurement. This scaling treatment should prove useful in optimization of practical strained-layer device structures.

3010 Magnetic studies of persistent photoconductivity in *n*-$Al_xGa_{1-x}As$. Khachaturyan, K.A. (Department of Materials Science and Mineral Engineering, University of California and Center for Advanced Materials, Lawrence Berkeley Laboratory, Berkeley, California 94720 (US)); Awschalom, D.D.; Rozen, J.R.; Weber, E.R. *Physical Review Letters (USA)*, 63(12): 1311-1314 (18 Sep 1989). DOE Contract AC03-76SF00098.

Low-temperature magnetic susceptibility measurements were made during illumination of *n*-$Al_2Ga_{1-x}As$ with *DX* centers to investigate the microscopic origin of persistent photoconductivity. Experiments using a dc SQUID magneto-optic microsusceptometer revealed the change of electronic susceptibility as a function of illumination time and temperature. The results indicate that the *DX* center is a paramagnetic donor with one unpaired electron.

3011 Theory of unusual anisotropy of magnetoresistance in organic superconductors. Lebed, A.G. (L. D. Landau Institute of Theoretical Physics, Kosygina 2, Moscow, U.S.S.R. (SU)); Bak, P. *Physical Review Letters (USA)*, 63(12): 1315-1317 (18 Sep 1989). DOE Contract AC02-76CH00016.

We suggest that weak electron tunneling between layers is responsible for the experimentally observed dramatic deviations from two-dimensional behavior in the magnetoresistance in the metallic phase of the quasi-two-dimensional conductors $(TMTSF)_2ClO_4$ and $(TMTSF)_2PF_6$. We predict a fine structure due to resonances in open orbits between motion parallel and perpendicular to the planes.

3012 Temperature dependence of acceptor-hole recombination in germanium. Darken, L.S. (Tennelec, 601 Turnpike, Oak Ridge, Tennessee 37830 (US)); Jellison, G.E. Jr. *Applied Physics Letters (USA)*, 55(14): 1424-1426 (2 Oct 1989). DOE Contract AC05-84OR21400.

The recombination kinetics of several centers (Zn^-, Cu^-, B^-, CuH^-_2, CuH^-_x, $Zn^•$, $Cu^•$, and $CuH^•_x$) in high-purity Ge have been measured as a function of temperature from 8 to 160 K by transient capacitance techniques and are significantly faster than expected from cascade theory. The cascade theory also gives the wrong temperature dependence, and the wrong z dependence. Instead, the data are generally fit by the expression $N_v/4p\tau_c \cong kT/h$ (p and τ_c are, respectively, the free-hole concentration in the sample and the experimental mean capture time for a center).

3013 Antiphase domain boundary formation in single-crystal chalcopyrite-structure $ZnGeAs_2$ grown on GaAs. Solomon, G.S. (Research Triangle Institute, Research Triangle Park, North Carolina 27709-2194 (US)); Posthill, J.B.; Timmons, M.L. *Applied Physics Letters (USA)*, 55(15): 1531-1533 (9 Oct 1989).

Using transmission electron microscopy we have observed antiphase domain boundaries in single-crystal (001) $ZnGeAs_2$ grown on vicinal (100) GaAs by organometallic vapor phase epitaxy. These antiphase domains boundaries pertain only to the cation sublattice of the chalcopyrite-structure $ZnGeAs_2$ and are initiated at the heteroepitaxial interface because there exists a level of ordering on the cation sublattice in the $ZnGeAs_2$ epitaxial film that is absent in the GaAs substrate. There are two possible types of displacement vectors characterizing these antiphase domain boundaries, and a zinc-blende-structure substrate orientation to eliminate the boundaries is suggested.

3014 Amorphous phase formation by solid-state reaction between polycrystalline Co thin films and single-crystal GaAs. Shiau, F.Y. (Department of Materials Science and Engineering, University of Wisconsin, Madison, Wisconsin 57306 (US)); Chang, Y.A. *Applied Physics Letters (USA)*, 55(15): 1510-1512 (9 Oct 1989).

The formation of an amorphous phase between Co thin films and GaAs substrates by solid-state reaction has been investigated by transmission electron microscopy and Auger electron spectroscopy. The amorphization is ascribed to the fast diffusion of Co in GaAs. The amorphous layer, after a 300 °C, 4.5 h annealing, is measured to be ~40 nm in thickness and has a broad composition range. Prolonged annealing at 300 °C or heat treatment at 340 °C results in the crystallization of the amorphous phase. This crystallization is found to initiate from the Co/amorphous phase interface and leads to the formation of a metastable, supersaturated phase. Finally, the equilibrium condition is reached by the decomposition of this intermediate phase into CoGa and CoAs.

3015 Enhanced electron spin polarization in photoemission from thin GaAs. Maruyama, T. (Department of Physics, University of Wisconsin, Madison, Wisconsin 53706 (US)); Prepost, R.; Garwin, E.L.; Sinclair, C.K.; Dunham, B.; Kalem, S. *Applied Physics Letters (USA),* 55(16): 1686-1688 (16 Oct 1989). DOE Contract AC02-76ER00881;AC03-76SF00515;AC05-84ER40150.

The polarization of photoemitted electrons from thin GaAs layers grown by molecular beam epitaxy has been measured. Polarization as high as 49% was observed for a 0.2-μm-thick GaAs sample at excitation photon wavelengths longer than 750 nm. The maximum polarization is dependent on the thickness of the GaAs layer, decreasing to about 41% for a 0.9-μm-thick GaAs sample.

3016 Surface exponents of trails in two dimensions at tricriticality: Computer simulation study. Meirovitch, H. (Supercomputer Computations Research Institute, Florida State University, Tallahassee, Florida 32306-4052 (US)); Chang, I.S.; Shapir, Y. *Physical Review [Section] A: General Physics (USA),* 40(5): 2879-2881 (1 Sep 1989).

Using the scanning simulation method, we study self-attracting trails (with energy ϵ per intersection) terminally attached to an impenetrable linear boundary on a square lattice at their tricrital collapse transition. Our results for the exponents of the partition functions are γ_1=0.634±0.025 (one end attached to the surface) and γ_{11}=−0.44±0.02 (both ends attached). These values (with 95% significance limits) are within the error bars of the numerical estimates of Seno and Stella [Europhys. Lett. 7, 605 (1989)] for self-avoiding walks (SAW's) at the *FTHETA*-point on the same lattice. Our results, however, differ significantly from the exact values derived by Duplantier and Saleur for SAW's on a dilute hexagonal lattice at the *FTHETA'* point. The collapse temperature T_t and the tricritical growth parameter μ are very close to their analytic bounds $-\epsilon/k_BT_t$=ln3 and μ=3.

3017 Time resolved x-ray diffraction study of laser annealing in silicon at grazing incidence. Buschert, J.R. (Purdue University, Physics Department, West Lafayette, Indiana 47907 (US)); Tischler, J.Z.; Mills, D.M.; Zhao, Q.; Colella, R. *Journal of Applied Physics (USA),* 66(8): 3523-3525 (15 Oct 1989).

The loss of crystallinity at the surface of a silicon single crystal exposed to intense pulsed laser irradiation has been observed by means of a grazing incidence diffraction technique. The Bragg peak is shown to disappear during melting, and gradually reappear during subsequent stages of recrystallization.

3018 Interfacial roughness in InAs/GaAs heterostructures determined by soft x-ray reflectivity. Woronick, S.C. (Department of Physics, State University of New York at Stony Brook, Stony Brook, New York 11794-3800 (US)); Yang, B.X.; Krol, A.; Kao, Y.H.; Munekata, H.; Chang, L.L. *Journal of Applied Physics (USA),* 66(8): 3566-3573 (15 Oct 1989).

X-ray reflectivity has been used to determine interfacial roughness of as-grown 250-A-thick InAs overlayers deposited on GaAs substrates by molecular-beam epitaxy under differing growth and substrate conditions. Results indicate that in each case the top surface was smooth, but that the buried interface separating these highly lattice-mismatched materials exhibits root-mean-square roughness parameters in the range of 10–19 A. As-stabilized growth produced the roughest InAs-GaAs (buried) interface, while In-stabilized growth on a slightly misoriented substrate produced the smoothest InAs-GaAs interface.

3019 Electronic bonding of buried interfaces determined by soft x-ray emission spectroscopy. Perera, R.C.C. (Center for X-ray Optics, Accelerator and Fusion Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720 (US)); Zhang, C.H.; Callcott, T.A.; Ederer, D.L. *Journal of Applied Physics (USA),* 66(8): 3676-3681 (15 Oct 1989). DOE Contract AC05-84OR21400.

A nondestructive technique to study the partial density of states of atoms at buried interfaces is presented. A high density of interface atoms has been mimicked by using a periodic multilayer structure. The silicon-carbon interface was used as a test case. Fifty alternating silicon-carbon layers were laid down, in which silicon layers nominally between 3 and 30 A in thickness alternate with carbon layer pairs approximately 30 A thick made by magnetron sputtering. The silicon $L_{2,3}$ emission spectra was excited by monochromatized synchrotron radiation, and the *s*-like partial density of states of the silicon valence band was obtained. The spectrum of the thinnest silicon layer is similar to that of silicon as an impurity. When there are approximately two layers of silicon, the spectrum resembles that of silicon carbide, and as the layers become thicker, the spectrum is similar to that of amorphous silicon.

3020 Single layer $Al_2O_3{\cdot}H_2O$ and multilayer $Al_2O_3{\cdot}H_2O$–SiO_2 optical coatings prepared from colloidal suspensions. Thomas, I.M. (Lawrence Livermore National Laboratory, P.O. Box 5508, Livermore, California 94550 (US)). *Applied Optics (USA),* 28(18): 4013-4016 (15 Sep 1989). DOE Contract W-7405-ENG-48.

Single layer coatings of $Al_2O_3{\cdot}H_2O$ have been prepared on fused silica and BK-7 substrates from aqueous colloidal suspensions of hydrated alumina at room temperature. These coatings were porous and had a refractive index of ~1.44. Multilayer, high reflectivity, dielectric coatings were also prepared by laying down quarterwave-thick, alternating coats of this alumina with silica, also prepared from colloidal suspension, and having a refractive index of 1.22. To achieve 99% reflectivity, 30–35 layers were required. Single shot, laser damage threshold measurements at 1064 nm wavelength with a pulse length of 10 ns were carried out on both the single layer and multilayer system. The thresholds averaged 21 and 12 J/cm^2, respectively.

3021 Thermophysical properties of the lanthanide sesquisulfides. I. Schottky functions and magnetic and electronic properties of γ-La_2S_3, γ-Ce_2S_3, γ-Nd_2S_3, and γ-Gd_2S_3. Westrum, E.F. Jr. (Department of Chemistry, University of Michigan, Ann Arbor, Michigan 48109 (US)); Burriel, R.; Gruber, J.B.; Palmer, P.E.; Beaudry, B.J.; Plautz, W.A. *Journal of Chemical Physics (USA),* 91(8): 4838-4848 (15 Oct 1989). DOE Contract W-7405-ENG-82.

Heat capacity measurements of four lanthanide sesquisulfides La_2S_3, Ce_2S_3, Nd_2S_3, and Gd_2S_3, prepared in the γ phase, have been obtained between 6 and 350 K by adiabatic calorimetry. The total heat capacity has been resolved into lattice, electronic, magnetic, and Schottky components. The Schottky contributions agree well with the calculated values based on the observed splitting of the ground-state manifold of the rare earth ions occupying sites of S_4 symmetry in the Th_3P_4 structure. The observed splitting is obtained from an analysis of the hot bands in the absorption spectrum and from direct observation of the Stark levels in the far infrared. The Stark levels (all doublets) for Ce_2S_3 ($^2F_{5/2}$) are 0, 185, and 358 cm^{-1}; for Nd_2S_3($^4I_{9/2}$), they are 0, 76, 150, 180, and 385 cm^{-1}. For La_2S_3, which has no Schottky or magnetic contributions to the heat capacity, the thermal data can be extrapolated to 0 K. The entropy for La_2S_3 at 298.15 K (as S^0/R) is 19.51. Schottky and magnetic ordering at lower temperatures in Ce_2S_3, Nd_2S_3, and Gd_2S_3 preclude such extrapolation techniques. Therefore the entropy at 298.15 K for these compounds $\{S^0 - S^0(7\ K)\}/R$, is 21.34, 22.38, and 20.05, respectively.

3022 Integral equation theory of the structure and thermodynamics of polymer blends. Schweizer, K.S. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)); Curro, J.G. *Journal of Chemical Physics (USA),* 91(8): 5059-5081 (15 Oct 1989). DOE Contract AC04-76DP00789.

Our recently developed RISM integral equation theory of the structure and thermodynamics of homopolymer melts is generalized to polymer mixtures. The mean spherical approximation (MSA) closure to the generalized Ornstein–Zernike equations is employed, in conjunction with the neglect of explicit chain end effects and the assumption of ideality of intramolecular structure. The theory is developed in detail for binary blends, and the random phase approximation (RPA) form for concentration fluctuation scattering is rigorously obtained by enforcing incompressibility. A microscopic, wave vector-dependent expression for the effective chi parameter measured in small angle neutron scattering (SANS) experiments is derived in terms of the species-dependent direct correlation functions of the blend. The effective chi parameter is found to depend, in

3023 Electron paramagnetic resonance investigations of divalent cobalt in single crystals of perovskite ($CaTiO_3$). Boldu O.,

J.L. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6056 (US)); Boatner, L.A.; Abraham, M.M. *Journal of Chemical Physics (USA)*, 91(8): 5117-5118 (15 Oct 1989). DOE Contract AC05-84OR21400.

The electron paramagnetic resonance (EPR) spectrum of Co^{2+} in $CaTiO_3$ was observed at 9 GHz in the temperature range of 10–15 K. The results establish that Co^{2+} occupies four magnetically inequivalent sites in the orthorhombic $CaTiO_3$ lattice. These sites become equivalent when the applied magnetic field is parallel to the so-called "pseudocubic" *b* axis of the crystal. The magnetic axes in the plane perpendicular to the pseudocubic axis make an angle of $\pm 28.5° \pm 0.5°$ with the *a* and *c* axes of the host lattice. The site symmetry is qualitatively similar to that of the aliovalent ions Er^{3+} and Yb^{3+} in $CaTiO_3$.

3024 Semiempirical modified embedded-atom potentials for silicon and germanium. Baskes, M.I. (Theoretical Division, Sandia National Laboratories, Livermore, California 94551-0969 (US)); Nelson, J.S.; Wright, A.F. *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6085-6100 (15 Sep 1989).

Semiempirical potentials for silicon, germanium, and their alloys are derived with use of the modified-embedded-atom-method formalism. Following Baskes [Phys. Rev. Lett. 59, 2666 (1987)], it is found that the host electron density which is a linear superposition of atomic densities in the embedded-atom method (EAM) must have an angular modification in order to properly describe the bond-bending forces in the diamond-cubic structure. The angular dependence of this host electron density was found to be in qualitative agreement with the density of a first-principles calculation. As in the EAM, the potential functions are determined by using the measured lattice constants, sublimation energies, elastic constants, and alloying energies of silicon and germanium. In addition, first-principles calculations of structural energies are used. The potentials are used to calculate the energetics and geometrics of point defects, surfaces, metastable structures, and small clusters. In all cases, the calculations have been compared to first-principles calculations and experiment when available. The calculations predict that the vacancy mechanism is the dominant diffusion mechanism in both silicon and germanium. Surface energies and relaxations of the low-index faces of Si and Ge are compared with first-principles calculations.

3025 Free-carrier absorption from Fibonacci sequences of δ-doped layers in silicon. Sernelius, B.E. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831 (US)). *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6218-6221 (15 Sep 1989). DOE Contract AC05-84OR21400.

Theoretical results are reported for the dynamical resistivity and free-carrier absorption from Fibonacci sequences of δ-doped layers in silicon. Distinct peaks develop, with increasing generation number, in the region of plasmon excitations and the spectra show self-similarity properties. Numerical results are presented for sequences with generation numbers 5, 10, and 15, corresponding to a total number of layers approximately equal to 10, 100, and 1000, respectively.

3026 Structural, electronic, and optical properties of polyacetylene from a total-energy local-density molecular-cluster approach. Ye, L. (Department of Physics and Astronomy and Materials Research Center, Northwestern University, Evanston, Illinois 60208 (US)); Freeman, A.J.; Ellis, D.E. *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6277-6284 (15 Sep 1989). DOE Contract FG05-85ER75215.

A self-consistent local-density total-energy molecular-cluster approach is used to study several fundamental structural, electronic and optical properties of *trans*- and *cis*-polyacetylene (PA). The use of extended basis sets in the linear combination of atomic orbitals (LCAO) representation and of accurate multipolar potential representations was found to be essential for obtaining accurate results. Chain clusters C_nH_{n+2} with increasing n=8, 12, 16, and 20 were investigated in order to assure convergence of physical quantities of interest. The ground-state density of states, energy gaps, and binding energies are obtained and compared with experimental results and results of other calculations. A gap of 1.68 eV is obtained for the *trans* case and 1.74 eV for *cis*. *trans*-PA is found to be a lower-energy state than *cis*-PA (by 0.1–0.2 eV per C_2H_2). Accompanying the Peierls transition from a metallic to semiconductor state, the dimerization energy is determined from optimized total-energy calculations on *trans*-PA to be about 0.02–0.03 eV/C_2H_2.

3027 Electronic structure of kink and kink-antikink defects in polyacetylene. Ye, L. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208 (US)); Freeman, A.J.; Ellis, D.E. *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6285-6291 (15 Sep 1989). DOE Contract FG05-85ER75215.

The electronic energy levels and charge distribution associated with kink (K) and kink-antikink (K-$\bar{K}$) defects in polyacetylene have been calculated with use of the first-principles local-density-functional theory. Finite-chain models with up to 40 carbon atoms were studied, in a self-consistent-field molecular-orbital approach. For the kink defect on *trans*-polyacetylene (PA), a half-filled midgap level was found, which corresponds to a neutral soliton having spin 1/2. Its formation energy was found to be 0.51 eV. Two defect levels were found for kink-antikink pair constructed on both the *trans*- and *cis*-PA chains. In the *trans* case, the formation energy is about 1.1 eV, which remains almost constant with increasing separation between K and $\bar{K}$. The formation energy in the *cis* case increases monotonically with increasing separation and ranges from 0.3 eV for two intervening C atoms to 1.5 eV for 18 C atoms between K and $\bar{K}$.

3028 Silicide structural evolution in high-dose cobalt-implanted Si(100) crystals. Tan, Z. (Department of Physics and Institute of Materials Science, University of Connecticut, Storrs, Connecticut 06269-3046 (US)); Budnick, J.I.; Sanchez, F.H.; Tourillon, G.; Namavar, F.; Hayden, H.C. *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6368-6373 (15 Sep 1989).

The silicide structure in high-dose [(1–8)$\times 10^{17}$ Co/cm^2] cobalt-implanted Si(100) crystals is studied by extended x-ray-absorption fine structure, x-ray diffraction, and Rutherford backscattering spectrometry. As the implant dose increases we observe silicide structural evolution from a locally ordered $CoSi_2$ at a dose of 1×10^{17} Co/cm^2, to long-range-ordered $CoSi_2$ and CoSi at 3×10^{17} Co/cm^2, and to a short-range-ordered and highly defective CoSi-like structure at 8×10^{17} Co/cm^2. We propose a model in which Co atoms preferentially occupy the interstitial site, first in silicon then in $CoSi_2$, to understand the silicide-formation mechanism in the implanted system. The short-range-ordered silicides, observed for the first time, and the structural evolution are discussed in terms of both the $CoSi_2$ and CoSi structures and the proposed model. Single-phase and strongly oriented $CoSi_2$ are obtained in samples annealed at 700 °C.

3029 Lattice relaxation of *DX*-like donors in $Zn_xCd_{1-x}Te$. Khachaturyan, K. (Department of Materials Science and Mineral Engineering, University of California, Berkeley, California 94720 (US)); Kaminska, M.; Weber, E.R.; Becla, P.; Street, R.A. *Physical Review [Section] B: Condensed Matter (USA)*, 39(9): 6304-6310 (15 Sep 1989).

The configuration-coordinate diagram was constructed for deep relaxed In impurities in $Zn_xCd_{1-x}Te$. On the basis of the Hall effect, deep-level transient spectroscopy, photoionization, and photoluminescence measurements it was shown that In donors in $Zn_xCd_{1-x}Te$ possess analogous properties to the so-called *DX* center in $Al_xGa_{1-x}As$. The absence of paramagnetic resonance from In donors suggests that In atoms form a mixture of In^+ and In^{3+} ions, in equal numbers. A persistent photo-EPR signal from mobile photoelectrons was observed after illumination at g=1.316 and could be thermally annealed. A strong broad, donor-acceptor-pair luminescence was found, with periodically spaced phonon lines at high excitation powers.

3030 Morphology of Langmuir-Blodgett multilayers: A near-total external fluorescence and reflectivity study. Bloch, J.M. (Exxon Research and Engineering Company, Clinton Township, Annandale, New Jersey 08801 (US)); Yun, W.; Mohanty, K.M. *Physical Review [Section] B: Condensed Matter (USA)*, 40(10): 6529-6533 (1 Oct 1989). DOE Contract W-31-109-ENG-38.

X-ray reflection and near-total external fluorescence (NTEF) of Langmuir-Blodgett multilayers of stearate salt were found to be in significant disagreement with a simple-layered structure. The different samples contained one foreign Mn stearate double layer

deposited at a different predefined depth for each sample. A binary model of voids accumulated in successive layers is proposed. The lacunar structure for the multilayer that originates with this model fits our reflectivity and NTEF results remarkably well and resolves long-standing discrepancies between optical and x-ray measurements.

3031 Neutron-powder-diffraction study of the structure and antiferromagnetic ordering in Pr_2CuO_4. Cox, D.E. (Physics Department, Brookhaven National Laboratory, Upton, New York 11713 (US)); Goldman, A.I.; Subramanian, M.A.; Gopalakrishnan, J.; Sleight, A.W. *Physical Review [Section] B: Condensed Matter (USA)*, 40(10): 6998-7004 (1 Oct 1989). DOE Contract AC02-76CH00016.

A neutron-powder-diffraction study has been carried out on Pr_2CuO_4, which has the *T'*-type structure of the new high-T_c electron superconductors. The compound orders antiferromagnetically at about 270 K. The magnetic intensities at 15 K can be equally well accounted for by a collinear magnetic structure with orthorhombic symmetry or a noncollinear structure with tetragonal symmetry. In both cases, Cu moments are coupled antiferromagnetically within the CuO_2 layers, the ordered moment being $0.48\mu_B$ at 15 K. Rietveld refinement at 298 and 15 K shows the crystal structure is essentially unchanged; in particular, there is no detectable distortion at low temperature.

3032 Ground-state and optical properties of Cu_2O and CuO crystals. Ching, W.Y. (Department of Physics, University of Missouri-Kansas City, Kansas City, Missouri 64110 (US)); Xu, Y.; Wong, K.W. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7684-7695 (15 Oct 1989).

The band structures of cubic Cu_2O and monoclinic CuO crystals have been calculated by means of the first-principles orthogonalized linear combination of atomic orbitals method. Using the wave functions obtained, the frequency-dependent interband optical conductivities are also evaluated. The results show Cu_2O to be a direct-gap semiconductor, while CuO is semiconductorlike with an intrinsic hole population at the top of the valence band (VB). By comparing with a variety of existing data, we conclude that band theory works extremely well for Cu_2O, but is less satisfactory for CuO. This could be due to strong correlation effects for states near the top of the VB in CuO. A careful reanalysis of optical data and excitonic spectra in Cu_2O in conjunction with our calculations suggests a complete reinterpretation of these data. A clear distinction between the intrinsic gap and the optical gap is argued. We conclude that the intrinsic gap in Cu_2O is of the order of 0.8 eV, while the optical gap is of the order 2.0–2.3 eV. The excitonic series in Cu_2O is due to the Coulombic attraction of the hole at the top of the VB and the electron in the next-higher conduction band (CB), not the lowest CB, because of the forbidden symmetry associated with angular-momentum conservation. This reinterpretation of the excitonic data is also consistent with a calculated low value for the static dielectric constant ϵ_0 of order of 4 for Cu_2O.

3033 Pressure dependence of the *DX* center in $Ga_{1-x}Al_xAs$:Te. Shan, W. (Department of Physics, University of California, Berkeley, Berkeley, California 94720 (US)); Yu, P.Y.; Li, M.F.; Hansen, W.L. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7831-7838 (15 Oct 1989).

The pressure dependence of the *DX* center in Te-doped ternary alloy $Ga_{1-x}Al_xAs$ with x=0.15, 0.25, and 0.35 has been studied. The pressure coefficients of the activation energies for emission and capture as well as the pressure coefficient of the thermal ionization energy were found to change sign when the band gap of $Ga_{1-x}Al_xAs$ changed from direct to indirect. The compositional dependence of these energies at atmospheric pressure has also been extrapolated from the pressure dependence. Similarities between the effects of changing pressure and Al mole fraction suggested that the properties of the *DX* center depend mainly on the host semiconductor conduction-band structure. The difference in the pressure dependence of the *DX* center when the band gap is direct as opposed to indirect suggests that the defect wave function has considerable contribution from the conduction-band minima near the *X* point of the Brillouin zone and not just from the *L*-point minima as has been proposed by many authors.

3034 Electrons and phonons in polymeric sulfur nitride. Springborg, M. (Nordisk Institut for Teoretisk Atomfysik (NORDITA), Blegdamsvej 17, DK-2100 Kobenhavn O, Denmark (DK)). *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7928-7938 (15 Oct 1989).

Results of first-principles calculations on a large number of geometries of a single, isolated, planar, periodic, infinite $(SN)_x$ chain are reported. The results are used in theoretically determining all four geometrical parameters, the single-particle energy bands, as well as frequencies and displacement patterns for frozen, zone-center, intrachain, in-plane phonons. The calculated values are compared with those derived from experiments and from other theoretical approaches. Finally, couplings between the electronic orbitals at the Fermi level and intrachain phonons are discussed.

3035 Near-edge x-ray-absorption fine-structure spectroscopy investigation of poly(ethylene oxide)-KI complexes. Yang, X.Q. (Department of Applied Science, Brookhaven National Laboratory, Upton, New York 11973-6000 (US)); Chen, J.M.; Skotheim, T.A.; Okamoto, Y.; Kirkland, J.; denBoer, M.L. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7948-7952 (15 Oct 1989). DOE Contract AC02-76CH00016.

We have measured the near-edge x-ray-absorption fine-structure spectra of the *K* edge of potassium in the polymer-salt complex poly(ethylene oxide)-KI. Changes are observed as a function of temperature due to modifications of the K-ion coordination. Comparison with model systems suggests that the lower activation energy of this ionic conducting polymer complex at elevated temperature (T>70 °C) is partially due to reduced oxygen complexation of the K ions.

3036 Low density microcellular carbon foams and method of preparation. Arnold, C. Jr.; Aubert, J.H.; Clough, R.L.; Rand, P.B.; Sylwester, A.P. To Dept. of Energy, Washington, DC. USA Patent 4,832,881. 23 May 1989. Filed date 20 Jun 1988. Int. Cl. C10B 31/00. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A low density, open-celled microcellular carbon foam is disclosed which is prepared by dissolving a carbonizable polymer or copolymer in a solvent, pouring the solution into a mold, cooling the solution, removing the solvent, and then carbonizing the polymer or copolymer in a high temperature oven to produce the foam. If desired, an additive can be introduced in order to produce a doped carbon foam, and the foams can be made isotropic by selection of a suitable solvent. The low density, microcellular foams produced by this process are particularly useful in the fabrication of inertial confinement fusion targets, but can also be used as catalysts, absorbents, and electrodes.

3037 Protective coating for alumina-silicon carbide whisker composites. Tiegs, T.N. To Dept. of Energy, Washington, DC. USA Patent 4,839,316. 13 Jun 1989. Filed date 26 Oct 1987. 6p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

Ceramic composites formed of an alumina matrix reinforced with silicon carbide whiskers homogenously dispersed therein are provided with a protective coating for preventing fracture strength degradation of the composite by oxidation during exposure to high temperatures in oxygen-containing atmospheres. The coating prevents oxidation of the silicon carbide whiskers within the matrix by sealing off the exterior of the matrix so as to prevent oxygen transport into the interior of the matrix. The coating is formed of mullite or mullite plus silicon oxide and alumina and is formed in place by heating the composite in air to a temperature greater than 1200°C. This coating is less than about 100 microns thick and adequately protects the underlying composite from fracture strength degradation due to oxidation.

3038 Carbonaceous film coating. Maya, L. To Dept. of Energy, Washington, DC. USA Patent 4,833,034. 23 May 1989. Filed date 26 Apr 1988. USA Patent Application 7,186,427. Int. Cl. C23C 16/26. 6p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method of making a carbonaceous film. It comprises heating tris(1,3,2-benzodiazaborolo)borazine or dodecahydro tris[1,3,2]diazaborine[1,2-a:1'2'-c:1"2"-e]borazine in an inert atmosphere in the presence of a substrate to a temperature at

which the borazine compound decomposes. The decomposition products deposit onto the substrate to form a thin, tenacious, highly reflective conductive coating having a narrow band gap which is susceptible of modification and a relatively low coefficient of friction.

40 CHEMISTRY

4001 Analytical and Separations Chemistry

Refer also to citation(s) 2110, 2163, 2862, 2864, 2937, 2943, 2994, 3084, 3624

3039 (AEEW-R–2227) **Matrix isolation-infrared and mass spectrometric studies of high-temperature molecules.** Dickinson, S. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Aug 1987. 56p. Order Number DE90607900. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Matrix isolation-infrared spectroscopy and mass spectrometry have been developed at AEE Winfrith to study the high-temperature vapour species which could be generated during a hypothetical severe reactor accident. The principles of the techniques and the instruments are described in detail, and examples of their application to specific systems discussed. Although these examples refer to high-temperature chemical species which are relevant to reactor safety assessments, the techniques are equally applicable to other processes where the characterisation of transient vapour-phase species is required. (author).

3040 (CEA-CONF–9289) **Optogalvanic spectroscopy in flames.** Berthoud, T.; Benchehida, M.; Mauchien, P. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI). 1987. 6p. (In French). (CONF-8707107–: 1. international conference on laser M2P, Lyon-Villeurbanne, France, 7-9 Jul 1987). Order Number DE89781528. Available from NTIS (US Sales Only), PC A02/MF A01.

none

3041 (CONF-8910287–1) **The effects of heavy metals on the scaling ability of $CaCO_3$ and $Mg(OH)_2$.** Peters, R.W.; Wentz, C.A. Argonne National Lab., IL (USA). 1989. 6p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From 1. regional meeting of the American Filtration Society; Houston, TX (USA); 30 Oct - 1 nov 1989. Order Number DE90002845. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Hard water (containing cations, primarily calcium and magnesium) can result in scaling (deposition) problems in heat exchange equipment and water distribution systems. In many municipalities, hard water is softened by precipitation, in which lime or soda ash is added to the hard water to precipitate calcium carbonate or magnesium hydroxide. The presence of heavy metals is known to affect the growth and nucleation of $CaCO_3$ and $Mg(OH)_2$ in continuous reactors. In this study, we examined the effects of four heavy metals (cadmium, lead, iron, and zinc) on the scaling ability of the $CaCO_3$–$Mg(OH)_2$ system in a mixed suspension/mixed product removal (MSMPR) crystallizer (reactor). The objectives of the study were to: measure the efficiency of hardness removal in the presence of heavy metals; measure the efficiency of heavy metal removal by the lime-soda ash water softening process; monitor the crystal morphology of the precipitates; measure the precipitation kinetics through a population balance analysis for the $CaCO_3$ system in the presence of heavy metals; and determine the scaling ability of the $CaCO_3$/$Mg(OH)_2$ system in the presence of heavy metals at various pH values. 8 refs., 5 figs., 1 tab.

3042 (IAERU–8802, pp. 119-130) **Neutron radiography application to archaeological and ethnological objects.** Masuzawa, Fumitake (Gango-ji Inst. for Research of Cultural Property, Ikoma, Nara (Japan)). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Mar 1989. (In Japanese). (CONF-8806441–: 4. IAERU seminar, Tokyo (Japan), 18 Jun 1988). In *Proceedings of IAERU seminar-4.* Order Number DE90705939. Available from NTIS (US Sales Only), PC A07/MF A01.

Neutron radiography testing (NRT) has been applied to several ancient relics using Kyoto University Research Reactor and the cyclotron-based facility of Sumitomo Heavy Industries, Ltd. Some of the results are presented with comments on the usage and applicability of NRT in researches of ancient cultural property. The objects studied are (1) unearthed Buddhist sutras in a bronze case, (2) unearthed glass beads, a silver hollow bead ball and string in a gilt copper alloy case with a lid, (3) a Tibetan Buddhist clay statue cushioned with cloth in a copper box with a glass window and (4) an excavated iron sword conserved and restored using synthetic resins. From comparisons with X-ray radiography testing, NRT is remarkably effective to distinguish organic objects from inorganic materials such as metals and pottery. (author).

3043 (IEN-DQUI-DIQUI-NT–01/80) **Zirconium nitrate preparation and analytical method of zirconium determination in extraction experiments. pt.1.** Azevedo, H.L.P. de. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Quimica. 1980. 8p. (In Portuguese). Order Number DE90607886. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The zirconium behaviour in extraction process with TBP using Zr-95 radiotracer is studied. Some methods for radionuclides production as well as, zirconium nitrate solution used by extraction are described. (M.J.C.).

3044 (INIS-BR–1627) **Geology and Geochronology of Abuna-Ariquemes-RO.** Lima, M.I.C. de; Silva, G.H.; Ortiz, L.R.C.; Santana Lamartin Montes, A. de; Marques, N.M.G.; Silva Junior, O.; Dias, J.L. Sociedade Brasileira de Geologia, Sao Paulo, SP (Brazil). 1988. 16p. (In Spanish). (CONF-8811277–: 35. Brazilian Congress of Geology, Belem (Brazil), 6-13 Nov 1988). Order Number DE90607848. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The basement is formed by the JAMARI COMPLEX high-grade terrains, which were intensily reworked in the Rondoniano Mobile Belt related period, by 1,500 m.y. ago. In the Jamari stratigraphic unit a Rb-Sr true isochrone has been obtained in the Ariquemes granulites giving 1,495 +- 38 m.y. with IR = 0,7086 +- 0.0007. Proterozoic metasedimentary sequences are only preserved in the Guajara-Mirim (Yata) region and in the surroundings of the Formoso river, by the COMEMORACAO GROUP. This medium-grade unit consists of a aluminous sedimentary sequence with NE-SW to E-W structural trend. In the Yata settlement a Rb-Sr true isochrone has been abtained, giving 1,157 +- 40 m.y., with IR=O.7189 +- 0.0021, which suggests that it has been affected by the Sunsas Mobile Belt. The remainders of a low-grade sequence derived from psamitic-pelitic sediments are also exposed in the FORTALEZA DO ABUNA GROUP, with pronounced NW-SE structural trend. The region was lately the ground for deposition of mainly continentally derived sediments, although marine facies and volcanics are associated, owing to the rifting and deposition of the MUTUM-PARANA and PALMEIRAL FORMATIONS. These events were followed by the emplacement, by 1,300 to 950 m.y. ago. of both, plutonic and basic volcanic rocks, of the CIRIQUIQUI INTRUSIVE SUITE and NOVA FLORESTA FORMATION. Simultaneously to the basic activity, a large intensive volcanic-plutonic activity took place randing from 1,350 to 950 m.y., represented by the RONDONIA INTRUSIVE SUITE, CARIPUNAS FORMATION acid volcanics and ALCALINAS TEOTONIO related intrusives. Rb-Sr true isochrones have been obtained in the RONDONIA INTRUSIVE SUITE granites of the Samuel Dam region (1,381 +- 122 m.y., IR = 0.7126) and Periquitos (1,297 +- 170 m.y., IR = 0,7100 +- 0.0137). (author).

3045 (INIS-BR–1699) **Addition compounds between trifluoromethanessulfonates and N,N-Dimethylacetamide (DMA).** Sao Paulo Univ., SP (Brazil). Inst. de Quimica. 1984. 141p. (In Portuguese). Order Number DE90607887. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Rare-earth complex ions were prepared using dissolution of hydrated lanthnide compounds in the species used as ligand, N,N-dimethylacetamide (DMA) followed by evaporation of the ligand excess, and by crystallization of the dissolved complexes in DMA medium using chloroform as precipitating agent. (M.J.C.).

3046 (INIS-BR–1700) **Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230,**

Th-228, Ra-226 and Ra-228 and its application in mineral waters. Costa Lauria, D. da. Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Quimica. 1986. 117p. (In Portuguese). Order Number DE90607849. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

A sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 in environmental samples and applied to the analysis of mineral waters is studied. Thorium isotopes are coprecipitated with lanthanium fluoride before counting in alpha spectrometer, the uranium isotopes are determined by alpha spectrometry following extraction with TOPO onto a polymenic membrane. Radium-226 is determined with the radom emanation technique. (M.J.C.).

3047 (INIS-BR–1701) **Analytical use of zide ion. Chemical equilibrium studies and correlates in U(VI)/N_3 and Co(III)/N_3 systems.** Silva, T.V. da. Sao Paulo Univ., SP (Brazil). Inst. de Quimica. 1984. 279p. (In Portuguese). Order Number DE90607877. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

A monographic study about the azide ion and its structure, as well as, references about the uranyl ion in aqueous medium, and its possible hydrolysis products are shown. Spectral studies of the U(VI), Fe (III) and Cu(II) systems, in azide medium are analyzed. (M.J.C.).

3048 (INIS-BR–1722) **Simultaneous determination of some nutrient elements in five varieties of maize by instrumental neutrons activation analysis.** Armelin, M.J.A.; Vasconcellos, M.B.A.; Nascimento, V.F.; Maihara, V.A.; Favaro, D.J.F.; Machado, L.M. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607850. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. MAIZE/activation analysis; MAIZE/nutrients; GAMMA SPECTROSCOPY; LI-DRIFTED GE DETECTORS; MAIZE; NUTRIENTS; NEUTRONS; SENSITIVITY; THERMAL NEUTRONS

3049 (INIS-BR–1723) **Some aspects of analytic control used in separation process of rare earths.** Silva Queiroz, C.A. da; Abrao, A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607888. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. RARE EARTHS/gravimetric analysis; RARE EARTHS/activation analysis; RARE EARTHS/x-ray fluorescence analysis; ABSORPTION SPECTROSCOPY; EXTRACTION CHROMATOGRAPHY; INTERFERING ELEMENTS; NEUTRONS; POLAROGRAPHY

3050 (INIS-BR–1725) **Determination of gadolinium in power and pellers of $(U,Gd)O_2$ by ion chromatography without supresion.** Pires, M.A.F.; Abrao, A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607890. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. GADOLINIUM/activation analysis; GADOLINIUM/quantitative chemical analysis; GADOLINIUM/x-ray fluorescence analysis; GADOLINIUM; ION EXCHANGE CHROMATOGRAPHY; URANIUM DIOXIDE; GADOLINIUM OXIDES

3051 (INIS-BR–1726) **Study on behaviour of voltametric wave of UO_2^{2+} in an electrode of mercury pendent drop and H_2SO_4 as suport electrolyte.** Carvalho, F.M.S. de; Abrao, A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607878. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. URANIUM OXIDES/voltametry; ELECTRODES; MERCURY; SULFURIC ACID; VOLTAMETRY

3052 (INIS-BR–1728) **Electrodeposition and evaporation techniques used for preparation of ^{239}Pu sources. Determination by alpha spectrometry.** Yamaura, M.; Goncalves, M.A.; Matsuda, H.T.; Araujo, B.F. de. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607891. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. PLUTONIUM 239/alpha spectroscopy; PLUTONIUM 239/electrodeposition; EVAPORATION; PH VALUE; ELECTRODEPOSITION

3053 (INIS-BR–1731) **Electrochemistry of pentaamminruthenium (II) complexes with cyanopyridinium ions.** Naal, Z.; Tfounni, E.; Rocha, Z.N. da; Benedett, A.V. UNESP, Araraquara, SP (Brazil). Inst. de Quimica. 1989. 10p. (In Portuguese). Order Number DE90607880. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The electrochemical behavior of four pentaaminnuthenium (II) complexes with cyanopyridimium ligands in aqueous solutions containing F_3CCO_2Na/F_3CCO_2H (μ=0,1 PH3) on a vitreous carbon electrode, at 25 and 2^0C is studied. The electrochemical oxidation of these compounds is described. (M.J.C.).

3054 (INIS-BR–1732) **Evaluation of the results from uranium chemical analysis by potentiometric tritation method for safeguards utilization through intercomparison programs.** Araujo, R.M.S. de; Almeida, S.G. de; Bezerra, J.H.B.; Silva, S.P. da. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Lab. de Salvaguardas. [1989]. 1p. (In Portuguese). Order Number DE90607881. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only.

3055 (INIS-BR–1754) **Spectrophotometric investigation of addition compounds between neodymium (III) and europium (III) perchorates and hexafluorophosphate and cyclic ligants with two oxygen in opposite position.** Oliveira, M.A.S. Sao Paulo Univ., SP (Brazil). Inst. de Quimica. 1986. 342p. (In Portuguese). Order Number DE90607852. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Addition compounds between Nd^{3+} and Eu^{3+} perchlorates and hexafluorophosphates with trans-1,4-dithino-1,4-dioxide (TDTD), pyrazine-1,4-dioxide (pyzDO), 2,5 - piperazinedione (pdo) and 1-4-diazabicyclo /2,2,2/-octane-1,4-dioxide or triethylenediamine dioxide (TEDADO) were prepared. The lanthanide content was determined by complexometric titration with EDTA. Carbon, hydrogen and nitrogen were determined by microanalytical procedures and water by the Karl Fischer method. The following stoichiometries were determined: $Nd(ClO_4)_3.6TDTD.8H_2O$; $Eu(ClO_4)_3.6TDTD.4H_2O$; $Ln(PF_6)_3.4TDTD.4H_2O$; $Ln(ClO_4)_3.4pyzDO$; $Ln(ClO_4)_3.4pdo$; $Ln(ClO_4)_3.3TEDADO.3H_2O$; $Ln(PF_6)_3.3TEDADO.3H_2O$ (Ln = Nd^{3+} and Eu^{3+}). X-ray powder patterns of the perchlorates show that the compounds of neodymium and europium with the respective ligands are isomorphous. The samme occurs in relation to Nd^{3+} and Eu^{3+} hexafluorophosphates. The results of the infared spectra, Raman spectra, absorption electronic spectra and fluorescence electronic spectra are also presented. (author).

3056 (INIS-BR–1760) **Simultaneous determination of Rn-220 and Rn-222 concentrations in atmospheres by cellulose nitrate ionographic detectors.** Lobao, N. Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Biofisica. 1977. 139p. (In Portuguese). Order Number DE90607853. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

A method for the indoor determination of airborne radon and radon daughters is described, based in the utilization of cellulose nitrate (CN) ionographic detectors (LR-115-Kodak-Pathe) These track-etching detectors are coupled to an air sample and to a difusion chamber respectively. In the first system ambient air is pulled through a fiber glass filter for collection of airborne radon daughters (Flow: 230 ml/min). In the second system, the cellulose nitrate detectors is coupled to a diffusion chamber electrostatic precipitator arrangement. Here the CN detector will register only the alpha particles given off by the decay products of Rn-222 formed within the sensitive volume of electrostatic precipitator. The construction of calibration curves for the two systems using adequate steady-state concentrations of Rn-220 and Rn-222 in an exposure chamber (1 cubic meter), will allow the use of the system for measurement of measurement of averaged integrated radon concentrations. The CN attached to the CN attached to the air sampler is exposed in the reference atmosphere with and without a mylar filter for discrimination of alpha particles with different energies Field sampling indicated however, that efficiency of the two systems are still low for

the measurement of environmental levels of Rn-220 and Rn-222 within houses of the AENR, recommendations for efficienty improvement of the system are proposed.

3057 (INIS-BR–1768) **Dating of aragonite and dolomite from Devil's cave - SP, by dosimetric thermoluminescent method (DTL) and ESR.** Tatumi, S.H. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. 1987. 114p. (In Portuguese). Order Number DE90607854. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

We have investigated TL (Thermoluminescence) and ESR (electron spin resonance) properties of aragonite and dolomite found at "Caverna do Diabo (Devil's cave)" in the state of Sao Paulo to determine the ages of these geological materials. The aragonite, which is not a thermoluminescent material, shows one ESR signal whit g = 2.003. We obtained the age of 1.1 x 10^5 years and the growth rate of 1 μ m/year by the sample calibration with additional Y irradiation. The dolomite gives a TL glow curve with three distinct peaks at 261, 334 and 395 ^{0}C. We found that the fit for the TL glow curve to second-order kinetics can be considerered as very acceptable. Using the second TL peak we obtained the age of 9.4 x 10^5 years and the compatible values of the activation energy (1.90 +- 0,07 eV) by the following methods: Hyperbolic heating, isothermal decay and fractional glow technique. We observed many ESR absorption signals in the dolomite. Three principal signal com g = 2.002, 2.003 and 2.005 were studied. We found that the first and second ESR signals were atributed to the CO_2^- and/or CO_3^{3-} centers and the last to the CO_3^- centers, and observed that the first ESR signal might related with the second TL peak and the TL sensitivity were associated with the concentration of Mn^{2+}.

3058 (INIS-BR–1770) **Study for the determination of samarium, europium,terbium, dysprosium and yttrium in gadolinium oxide matrix by means of atomic absorption spectrophotometry using a graphite furnace.** Caires, A.C.F. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). 1985. 121p. (In Portuguese). Order Number DE90607893. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

A study for determination of samarium, europium, terbium, dysprosium and yttrium in a gadolinium oxide matrix by atomic absorption spectrophotometry using a graphite furnace is presented. The best charrring and atomization conditions were estabilished for each element, the most convenient ressonance lines being selected as well. The study was carried out for the mentioned lanthanides both when pure and when in binary mixtures with gadolinium, besides those where all for them were together with gadolinium. The determination limits for pure lanthanides were found to be between 1.3 and 9.6 ng assuming a 20% relative standard deviation as acceptable. The detection limits were in the range 0.51 and 7.5 ng, assuming as positive any answer higher than twofold the standard deviation. (author).

3059 (INIS-mf–12013, pp. 161) **Thermoluminescence dating of archaeometallurgical slags and ceramics.** Lorenz, I.; Wagner, G.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Thermoluminescence dating is applied to archaeometallurgical slags and to ancient ceramics. (orig.).

3060 (INIS-mf–12013, pp. 161-162) **Thermoluminescence dating of sediments.** Sauer, W.; Wagner, G.A.; Zoeller, L. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

TL dating of loess, using the 'strong thermal washing' technique, yields geologically consistant ages up to 300 ka. The optical resetting of the TL of natural potassium feldspar is investigated. (orig.).

3061 (INIS-mf–12013, pp. 162) **Optically stimulated luminescence.** Petzold, R.; Wagner, G.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Optically stimulated luminescence is investigated as age indicator of sediments. (orig.).

3062 (Juel–2212) **Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis.** Wuerfels, M. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie; Bochum Univ. (Germany, F.R.). Jul 1988. 219p. (In German). Order Number DE90721938. Available from NTIS (US Sales Only), PC A10/MF A01.

This work mainly investigates the influence of organic residues from the pressurized decomposition of biological materials on the current of inverse voltammetric trace signals. The emphasis lies on the following subtasks: 1. optimization of the parameters for the pressurized decomposition with hydrochloric acid at temperatures of up to 200^{0}C using selected sample materials. 2. Experiments on the aftertreatment of organic residues with perchloric acid. 3. Experiments on the pressurized decomposition with nitric acid at temperatures of up to 300^{0}C using a self-built system and the commercial high-pressure incinerator according to Knapp. 4. Examination of the voltammetric diagrams of decomposition liquors for possible disturbances in the determination of Zn, Cd, Pb and Cu. 5. Experiments on the isolation of the decomposition residues of different sample materials and on the identification of the undecomposed substances. 6. Investigations on the mechanism of the disturbance of electrochemical reactions caused by decomposition residues. 7. Investigations on the mechanism of the decomposition of biological material by way of pressurized decomposition with nitric acid. (orig./RB).

3063 (KCP–613-4127) **High-temperature gel-permeation chromatography of poly(4-methyl-1-pentene).** Fuller, E.N.; Edwards, G. Jr. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. 1989. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. (CONF-8908176–1: Waters '89: international GPC symposium, Newton, MA (USA), 28 Aug 1989). Order Number DE90002967. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A high-temperature gel-permeation chromatographic (HTGPC) method has been developed for molecular weight (MW) characterization of poly (4-methyl-1-pentene), PMP. Like most high-MW polyolefins, PMP is difficult to handle because of solubility problems. Techniques for overcoming the solubility problems are discussed. The effects of sample concentration and of extended analysis temperature exposure on the results obtained by HTGPC were investigated. Thermo-oxidative degradation of the polymer could be readily observed despite the addition of an antioxidant and thermal stabilizer to the carrier solvent. The rate of degradation for PMP appeared to be greater than for polypropylene (PP) or for polyethylene (PE) as was expected based on the branched structure of PMP. Efforts to reduce degradation are described. Results for two commercial grades of PMP, one in pellet form for injection molding and another in bar stock form for machining, are presented. Results from two in-house developmental PMP type resins are compared with those from the pellet type. 8 refs., 12 figs.

3064 (KFK–4622) **Analytical studies of plutonium containing solutions by Laser-Raman-Spectroscopy (LRS) with special regard to the Pu(IV)-Ru(III)-HNO_3 and Pu(VI)-H_2O_2-reactions.** Freudenberger, M. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie. Aug 1989. 139p. (In German). Order Number DE90722448. Available from NTIS (US Sales Only), PC A07/MF A01.

In spent nuclear fuel reprocessing by the Purex process it is attempted to apply as far as possible automated analytical equipment, which is directly coupled to the process stream. This paper describes the optical coupling of Laser-Raman-Spectroscopy (LRS) with commercial fiber optics in a 90^0 geometry to a test apparatus within a glovebox. It was possible to show that in nitric acid solutions Pu(VI), Pu(V), U(VI), and nitrate can be detected simultaneously without interference. The suitability of LRS for the Pu(VI)

and Pu(V) detection was demonstrated by the example of two reactions, namely the oxidation of Pu(IV) to Pu(VI) in nitric acid solution in the presence of Ru(NO)-complexes and the reduction of Pu(VI) to Pu(V) by H_2O_2. In the study of the Pu(IV)-Ru(NO)-reaction the temperature and the concentrations of the individual reactants were varied and in addition the concentration of F^-, which as a strong complexing agent for Pu(IV) exerts a considerable influence on the reaction rate. The results of these experiments were used to estimate the reaction orders for the individual reactants by the method of initial rates. The course of the reduction of Pu(VI) to Pu(V) with H_2O_2 was studied for different temperatures, pH-values and F^--concentrations. (orig./RB).

3065 (PB–89-871230/XAB) **Membrane gas separation. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 66p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868641.

This bibliography contains citations concerning the research and development of gas separation and purification utilizing plastic and metal membranes. Among the topics included are isotope separation, osmotic techniques, reverse osmosis, and preparation of membranes for specific separation processes. The permeability of polymer membranes is discussed in terms of physical properties as well as molecular structure. The selectivity of polymeric films for a variety of gases is also included. (This updated bibliography contains 100 citations, 18 of which are new entries to the previous edition.)

3066 (PCCF-T–88-16) **Elementary analysis by means of the x fluorescence and energy dispersion.** Jbeli, H. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. Oct 1988. 194p. (In French). Order Number DE90721244. Available from NTIS (US Sales Only), PC A09/MF A01.

Three actualisation reports are shown, in the three first chapters, concerning the following subjects: x fluorescence principle, energy dispersive X ray spectroscopy and excitation spectrum characteristics. The matrice effects, the energy equivalence concept, and the correction methods of the interelement effects, related to a calibration curve, are discussed. For the last ones, it is shown that they are supplied to rough values. Quantitative analysis results are shown. A new possibility has been added to those of data processing program usually applied in quantitative analysis. In the second method applied in quantitative analysis, standard samples are used. In both methods an error appreciation analysis is carried out. It is shown that energy dispersive X fluorescence analysis can be applied to thin layers composition and thickness characterization.

3067 **Polarization spectroscopy in analytical measurements.** Yeung, E.S. (Department of Chemistry and Ames Laboratory, Iowa State University, Ames, Iowa 50011 (US)). *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 764-769 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

A new generation of instruments has been developed for using the polarization properties of light in sensitive and selective chemical measurements. The detection of rotation of the plane of polarization of light is at the micro degree level. The detection of the intensity differences between left and right circularly polarized light is at the parts-per-million level. These are orders of magnitude better than commercial instruments can provide.

4002 Inorganic, Organic and Physical Chemistry

Refer also to citation(s) 2020, 2026, 2028, 2049, 2059, 2061, 2065, 2076, 2092, 2110, 2256, 2271, 2443, 2828, 2940, 2989, 2990, 2992, 2993, 3109, 3381, 3436, 3760, 3934, 4218

3068 (AEEW-R–2305) **Characterisation of molecular boric acid by mass spectrometry and matrix isolation-infrared spectroscopy.** Ogden, J.S.; Young, N.A.; Bowsher, B.R. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Oct 1987. 37p. Order Number DE90607901. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Boric acid (H_3BO_3) is used as a soluble neutron absorber in the coolant of pressurised water reactors and will be an important species in defining the fission product chemistry of severe reactor accidents. Mass spectrometry and matrix isolation-infrared spectroscopy have been used to characterise boric acid in the vapour phase and hence assess the implications of any chemical interactions. Crystalline orthoboric acid vaporises to yield molecular H_3BO_3 when heated in vacuum to approximately 40^0C. The infrared spectrum of the vapour species isolated in low-temperature nitrogen matrices shows characteristic absorptions at 3668.5 (E'), 1426.2 (E'), 1009.9 (E'), 675.0 (A"), 513.8 (A") and 448.9 (E') cm^{-1}, consistent with C_{3h} symmetry. These spectral assignments are supported by extensive isotope labelling, and by a partial normal co-ordinate analysis. These data will be used to quantify specific thermodynamic functions and hence assist in determining the magnitude of reactions such as boric acid with caesium iodide. (author).

3069 (AEEW-R–2341) **New estimates for the thermodynamic functions of molecular boric acid.** Bowsher, B.R.; Dickinson, S.; Ogden, J.S.; Young, N.A. UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div. Mar 1988. 9p. Order Number DE90607902. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Orthoboric acid (H_3BO_3) is used as a soluble neutron absorber in the coolant of pressurised water reactors and will be an important species in defining the fission product chemistry of severe reactor accidents. New thermodynamic data are presented for molecular boric acid, which are based almost entirely on matrix isolation-infrared experimental observations. In general, it is found that over the temperature range 500 to 1500K, the specific heat and absolute entropy show differences of approximately 5% compared with the JANAF tabulations. As a consequence of these calculations, the reaction between caesium iodide and boric acid is predicted to be more favoured than previously considered, and this conclusion confirms experimental studies on this system. (author).

3070 (BNL–42573) **Atomic mass measurements with radioactive beams and/or targets: Where to start.** Haustein, P.E. Brookhaven National Lab., Upton, NY (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8909247–3: ACS symposium on exotic nuclear spectroscopy, Miami Beach, FL (USA), 11-15 Sep 1989). Order Number DE90001532. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Radioactive beams or radioactive targets (or both) can significantly increase the yields of exotic isotopes, allowing studies to be performed in regions which are currently inaccessible. An important goal to pursue with these exotic species is a broad program of nuclidic mass measurements. This is motivated by the observation that mass model predictions generally diverge from one another in regions far from beta-decay stability where well measured masses are sparse or nonexistent. Stringent tests of mass models are therefore possible and these can highlight important features in the mass models that affect the quality of their short-range and long-range extrapolation properties. Selection of systems to study can be guided, in part, by a desire to probe those regions where distinctions among mass models are most apparent and where exotic isotope yields will be optimal. Several examples will be presented to highlight future opportunities in this area. 10 refs., 5 figs.

3071 (BNL–43214) **Direct insertion of metal ions into tetrasulfonated phthalocyanine.** Linkous, C.A.; Shea, C.E.; Jaber, M.R.A. Brookhaven National Lab., Upton, NY (USA). Jul 1989. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90002458. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A series of metal salts were reacted with aqueous solutions of the tetrasulfonated free base phthalocyanine (H_2TsPc) in an attempt to prepare the corresponding metal TsPc derivative by direct insertion instead of the usual template reaction in a urea melt. Spectrophotometric analysis showed that Ni^{2+}, Cu^{2+}, Zn^{2+}, Co^{2+}, Fe^{2+}, Mn^{2+}, Pd^{2+}, Cd^{2+}, and Sn^{2+} could be successfully inserted; higher oxidation states as well as Pb^{2+} caused precipitation. Reducing species

such as Cr^{2+} and V^{2+} reduced H_2TsPc but did not insert; Sn^{2+} inserted with formation of an air-sensitive intermediate species. Mg^{2+}, VO^{2+}, Pt^{2+}, and Hg^{2+} were unreactive. It is recommended that insertion may be the preferable method for synthesis of the MTsPc's listed above when air sensitivity, reaction time, and microscale are important issues in an overall synthetic scheme. 24 refs., 4 figs.

3072 (CONF-890756–3) **Corrections for non-ideal effects in reflected shock waves at low Mach numbers.** Michael, J.V.; Fisher, J.R. Argonne National Lab., IL (USA). 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 17. international symposium on shock waves and shock tubes (STS-17); Bethlehem, PA (USA); 17-21 Jul 1989. Order Number DE90002192. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Recent and new Flash Photolysis-Shock Tube results are reviewed and are compared to lower temperature results on the same reactions using a recently described procedure for boundary layer corrections in the reflected shock regime. A comparison is also made to the lower temperature results when the data bases are alternatively analyzed by ideal shock wave theory. 20 refs., 7 figs.

3073 (CONF-891013–7) **Molecular clustering in supercritical solutions.** Cochran, H.D.; Wu, R.-S.; Lee, L.L. Oak Ridge National Lab., TN (USA). [1989]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 6. symposium on separation science and technology for energy applications; Knoxville, TN (USA); 22-27 Oct 1989. Order Number DE90002480. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present results on the size and radial profile of solvent-solute clusters and on solute-solute aggregation for systems representative of typical dilute, attractive, supercritical solutions calculated from integral equation theories. The microstructure of theoretically-predicted dilute, repulsive, supercritical solutions exhibits a deficit of solvent molecules surrounding the solute. Solute partial molar volume and chemical potential are predicted to increase dramatically in such repulsive mixtures as density is increased toward the critical point at slightly supercritical temperatures. 32 refs., 8 figs.

3074 (DOE/ER/13295–3) **Transition metal catalyzed transformations of unsaturated molecules.** Pennsylvania State Univ., University Park, PA (USA). [1989]. 69p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER13295. Order Number DE90002767. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In this proposal, research in three areas of transition metal catalyzed transformations of small molecules is proposed. The first encompasses metal catalyzed processes for the synthesis of several classes of carbon monoxide containing polymers. This section describes plans for metal catalyzed synthesis of (a) new alternating copolymers of carbon monoxide and olefins, (b) block copolymers consisting of segments of the olefin homopolymer and the olefin-carbon monoxide alternating copolymer, and (c) polycarbonates, polyesters and polyamides. The second section involves the examination of the chemistry of metal complexes incorporating oxo and hydrocarbyl ligands as a model for the heterogeneous oxidation of olefins and alkanes by meal oxides. Specific plans are to mimic in solution two proposed key steps in the heterogeneous oxidations. These are (a) the heterolytic cleavage of an alkyl (or allyl) C-H bond that is assisted by an oxo group, and (a) the transfer of an oxo group to the resultant metal bound alkyl (or allyl) ligand. The third section concerned with the development of a hybrid catalyst system involving both homogeneous and heterogeneous components for the oxidative functionalization of alkanes. The basic idea is to employ a transition metal in the elemental state to activate C-H bonds of alkanes and form surface alkyl groups. An additional transition metal species will be present in solution which will serve to oxidize these surface alkyl groups to ultimately yield oxidatively functionalized organic products. 57 refs.

3075 (DOE/ER/13855–2) **Stable isotope studies: Progress report, October 1988–October 1989.** Ishida, Takanobu. State Univ. of New York, Stony Brook, NY (USA). Dept. of Chemistry. 23 Oct 1989. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13855. Order Number DE90002882. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have been engaged in the experimental and theoretical studies in two subfields of isotope science and technology this year; (1) studies of electric-potential-assisted heterogeneous catalysis (EPAC) of hydrogen isotope exchange reaction between water and dihydrogen and (2) studies of liquid ammonia systems. Since our activities in Category 1 above have branched out into many directions, what we have done and what we currently plan to do in this area have been summarized in a chart. Some deviations of our activities from the original plan are noted. There have been no principal change in the scope of our scientific activities. Some details of progress other than those already published or submitted for publication are reported.

3076 (INIS-BR–1698) **Cholesteric lyomesophases based on sodium N-lauroyl asparte: characterization of new system by nuclear magnetic resonance and polarizing microscopy.** Melo, M.V.M.C. de. Sao Paulo Univ., SP (Brazil). Inst. de Quimica. 1982. 147p. (In Portuguese). Order Number DE90607262. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Lyomesophases based on di-sodium N-lauroyl aspartate (SNLA), bi-carboxilated amphiphile obtained from the reaction of n-lauroyl chloride with aspartic acid in racemic or levo form are studies. The different mesophases were characterized by ^2H and ^{23}Na NMR and by polarizing microscopy. (M.J.C.).

3077 (LBL–27937) **Quantum mechanical reactive scattering theory for simple chemical reactions: Recent developments in methodology and applications.** Miller, W.H. Lawrence Berkeley Lab., CA (USA). Aug 1989. 9p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC03-76SF00098. CHE84-16345. (CONF-890708–10: 16. international conference on the physics of electronic and atomic collisions, New York, NY (USA), 26 Jul - 1 aug 1989). Order Number DE90003120. Available from NTIS, PC A; OSTI; INIS; GPO Dep.

It has recently been discovered that the S-matrix version of the Kohn variational principle is free of the "Kohn anomalies" that have plagued other versions and prevented its general use. This has made a major contribution to heavy particle reactive (and also to electron-atom/molecule) scattering which involve non-local (i.e., exchange) interactions that prevent solution of the coupled channel equations by propagation methods. This paper reviews the methodology briefly and presents a sample of integral and differential cross sections that have been obtained for the $H + H_2 \rightarrow H_2 + H$ and $D + H_2 \rightarrow HD + H$ reactions in the high energy region (up to 1.2 eV translational energy) relevant to resonance structures reported in recent experiments. 35 refs., 11 figs.

3078 (LBL–27938) **Theoretical methods for the study of chemical dynamics.** Makri, N. Lawrence Berkeley Lab., CA (USA). Apr 1989. 189p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90003122. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Theoretical methods are developed for studying the dynamics of chemical reactions. Many chemical processes can be adequately described as a "system" of one or two reaction coordinates coupled to a "bath" of harmonic oscillators. Such a formulation of the problem has obvious advantages as it is often possible to integrate out the harmonic bath, thus reducing the many degree of freedom problem to a one or two dimensional calculation. A simple semiclassical model for incorporating tunneling effects in classical trajectory simulations is constructed and shown to give excellent results over a variety of conditions. Feynman path integration provides an exact way of calculating quantum, dynamical properties and is in principle applicable to problems of involving many degrees of freedom. However, the standard Monte Carlo methodology which must be used to evaluate the multidimensional integrals that occur, is not directly applicable to the path integral expression for the real time propagator, because the integrand of the latter is highly, oscillatory. A technique which helps circumvent this problem by sampling about the stationary phase points of the integrand is developed and illustrated with several numerical applications. A new effective real time propagator is also constructed, which is localized and devoid of rapid oscillations. Finally, accurate approximations to the short time propagator

are derived, which drastically improve the convergence characteristics of path integrals. These techniques are expected to extend the applicability of path integral calculations to more complex chemical problems. 258 refs., 63 figs., 3 tabs.

3079 (LBL–27940) **Some new theoretical methods for treating reaction dynamics in polyatomic molecular systems.** Miller, W.H.; Chang, Yan-Tyng; Makri, N. Lawrence Berkeley Lab., CA (USA). Jul 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8907165–1: NATO advanced study institute meeting, Istanbul (Turkey), 30 Jul - 12 aug 1989). Order Number DE90003115. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Many useful descriptions of dynamical processes in polyatomic molecular systems are based on a reaction path approach. I.e., the potential energy surface is approximated as a multidimensional harmonic valley about a (curved) line in the 3N-6 dimensional space of the N atom system along which the motion is thought to be most localized. These lectures briefly review this reaction path methodology, but then focus mainly on some more recent approaches that go beyond the reaction path point of view. In particular, it is shown how empirical potential functions can be combined with selected ab initio calculations within an empirical valence bond model in order to construct a global potential energy surface for polyatomic reactions. Two other topics that are discussed are a new way of handling zero point energy in a classical trajectory simulation of polyatomic dynamics and a new model for including tunneling effects in a trajectory simulation. 30 refs., 1 fig.

3080 (PPA-T–85) **Synthesis of acrylated urethane oligomer.** Mohamad Hilmi bin Mahmood; Hussin bin Mohd Nor; Dahlan bin Haji Mohd. Unit Tenaga Nuklear, Bangi, Selangor (Malaysia). Nov 1988. 8p. Order Number DE90607903. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Acrylated urethane oligomer was synthesized using poly (propylene) diol MW 1000, toluene diisocyanate (TD1) and 2-hydroxyethyl acrylate (HEA) at 50-90^{0}C. (author).

3081 (SAND–89-0691) **ANEOS [analytic equation of state package] models for shock compression of saturated limestone: Applications to ground shock calculations.** Brown, W.T. Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 69p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE90002359. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Simple mixture rules are used to calculate input parameters for an analytic equation of state package (ANEOS) to model saturated limestone as a homogeneous material. This method is used to determine changes in material parameters as the volume fraction of water in the rock changes. Hugoniots determined from these are compared with experimental and theoretical Hugoniots for saturated limestone samples with various porosity levels. Ground shock calculations are also performed to model a deeply buried 500 kiloton explosion in saturated limestone containing various amounts of water. 37 refs., 29 figs.

3082 **A single turnover (STO) characterization of supported palladium catalysts.** Augustine, R.L. (Dept. of Chemistry, Seton Hall Univ., South Orange, NJ (US)); Baum, D.R. vp of Microstructure and properties of catalysts. Treach, M.M.J.; Thomas, J.M.; White, J.M. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711205–: Symposium on microstructure and properties of catalysts, Boston, MA (USA), 30 Nov - 3 dec 1987).

The STO catalyst characterization procedure has been applied to a variety of supported Pt catalysts. This paper describes an application of this technique to the characterization of supported Pd catalysts which showed that there were several significant differences between the Pt and the Pd catalysts. Under STO reaction conditions each surface site on a Pt catalysts reacts only once so there is a 1:1 relationship between the product composition and the densities of the various types of active sites present. With Pd catalysts under these same conditions, alkene isomerization takes place so readily that the amount of isomerized product formed depends on the contact time of the reactant pulse with the catalyst so there is no direct relationship between the amount of isomerization and the number of isomerization sites present.

3083 **Analysis of a diffusion-limited island growth mechanism for chemisorption and epitaxy.** Evans, J.W. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011 (US)). *Physical Review [Section] A: General Physics (USA)*, 40(5): 2868-2870 (1 Sep 1989). DOE Contract W-7405-ENG-82.

We consider an island growth mechanism wherein species adsorbed on top of two-dimensional islands diffuse to the edge and are then incorporated. A simple matrix formulation is developed for this random-walk problem which allows exact calculation of the growth probability distribution, neglecting island rearrangement. Furthermore, we also show how related trapping probabilities can be calculated recursively for various stages of island growth. The case of imperfect trapping at island edges is also considered, and reduction to Eden-model–type growth in the low-trapping-probability regime is demonstrated. In general, the growing islands are rounder and have fewer defects and narrower active zones than Eden clusters.

3084 **High resolution spectroscopic detection of acetylene–vinylidene isomerization by spectral cross correlation.** Chen, Y. (Department of Chemistry and George R. Harrison Spectroscopy Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (US)); Jonas, D.M.; Kinsey, J.L.; Field, R.W. *Journal of Chemical Physics (USA)*, 91(7): 3976-3987 (1 Oct 1989).

Information about the unimolecular acetylene (HC 3/4 CH)↔vinylidene (H_2C=C:) isomerization on the S_0 energy surface has been extracted from vibrationally unassigned high resolution stimulated emission pumping (SEP) spectra of acetylene. The combination of a new pattern recognition scheme, spectral cross correlation (SCC) with complete nuclear permutation-inversion (CNPI) group theory is shown to be a powerful new technique for characterizing bond rearrangement in highly vibrationally excited normally rigid polyatomic molecules. SCC detects isomerization "resonances" which destroy an approximate vibrational symmetry (e.g., the number of *cis*-bending quanta). The energies (relative to the zero point level of the stablest isomer) and widths of such resonances provide information about the "energies" of isomer rovibrational levels and the isomer-level-specific isomerization rate. Vinylidene isomerization resonances may be distinguished from ordinary acetylene Fermi or Coriolis perturbations by a unique rotational symmetry dependence due to the correlation between acetylene [$D_{\infty h}$(M)] and vinylidene [C_{2v}(M)] levels in the CNPI group G_8. An SCC map of the HCCH S_0 15 000–15 900 cm^{-1} energy region above the zero point level was obtained by comparing SEP spectra recorded via $S_1(\tilde{A}\ ^1A_u)3^3$ and 2^16^2 K_a=1 intermediate levels. The predicted rotational symmetry dependence of the SCC was found between 15 410–15 640 cm^{-1}, but the vinylidene resonance line shape was obscured by Franck–Condon interference effects from well known perturbations between the 3^3 and 2^16^2 SEP intermediate levels.

3085 **Bimodal kinetic energy release in the unimolecular dissociation of energy-selected formic acid ion.** Nishimura, T. (Department of Chemistry, University of Nebraska-Lincoln, Lincoln, Nebraska 68588-0304 (US)); Meisels, G.G.; Niwa, Y. *Journal of Chemical Physics (USA)*, 91(7): 4009-4018 (1 Oct 1989).

Dissociation of HCOOH$^+$ and DCOOH$^+$ have been studied using threshold photoelectron–photoion coincidence (TPEPICO) mass spectrometry. The detailed breakdown diagrams were obtained over internal energies of the molecular ion less than 8 eV. Kinetic energy release distributions (KERDs) for HCO$^+$ and DCO$^+$ were extracted from their flight time distributions by using a multiple linear regression method. The breakdown curve of HCO$^+$ not only exhibited several maxima but also the surprisal analysis of its KERD demonstrated a considerable deviation from a single statistical distribution. Bimodal KERDs were observed for the formation of HCO$^+$ and DCO$^+$. The large KER component results from dissociation to the products in the ground state, HCO$^+$ ($^1\Sigma^+$)+·OH ($^2\Pi_i$). Average kinetic energy releases observed for this process are, however, about twice higher than those calculated by QET/RRKM. The small KER component shows average KERs remarkably smaller than the statistical expectations and this value remains constant over the energy range of 4.5 eV. The origin of this small KER component was ascribed to dissociation after fluorescent transition of initial vibronic

states to the first excited state (1 $^2A''$). In contrast with these results average KERs measured for H_2O^+ and HDO^+ are in good agreement with the RRKM/QET calculations.

3086 A semiclassical tunneling model for use in classical trajectory simulations. Makri, N. (Department of Chemistry, University of California, and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720 (US)); Miller, W.H. *Journal of Chemical Physics (USA),* 91(7): 4026-4036 (1 Oct 1989). DOE Contract AC03-76SF00098.

A semiclassical model for tunneling from one classically allowed region on a potential energy surface to another is described. The principal feature of this model, compared to earlier (more "rigorous") multidimensional semiclassical tunneling theories, is that it can be implemented in a straightforward way within the framework of a standard classical trajectory simulation. Applications to several examples of unimolecular isomerization and unimolecular dissociation show that the model is capable of providing excellent results over a wide range of conditions (i.e., coupling strengths, different symmetries of couplings, etc.)

3087 Evaluation of the rate constant for the reaction $OH+H_2CO$: Application of modeling and sensitivity analysis techniques for determination of the product branching ratio. Yetter, R.A. (Department of Mechanical and Aerospace Engineering and Department of Chemistry, Princeton University, Princeton, New Jersey 08544 (US)); Rabitz, H.; Dryer, F.L.; Maki, R.G.; Klemm, R.B. *Journal of Chemical Physics (USA),* 91(7): 4088-4097 (1 Oct 1989). DOE Contract AC02-76CH00016.

Novel modeling and sensitivity analysis techniques are used with experimental data obtained from discharge flow–resonance fluorescence experiments to evaluate the product branching ratio of $OH+H_2CO$. Two channels are considered: the H-atom abstraction reaction (R2) to form HCO and H_2O; and the addition reaction (R17) followed by rearrangement and decomposition to form HCOOH and H. The rate constant values obtained at 298 K are $k_{R2}=(7.75\pm1.24)\times10^{-12}$ cm^3/molecule s and $k_{R17}=(0.2^{+0.8}_{-0.2})\times10^{-12}$ cm^3/molecule s. The results demonstrate that the reaction proceeds almost exclusively via the H-atom abstraction pathway.

3088 X-ray diffraction study of liquid *n*-butane at 140 and 267 K. Habenschuss, A. (Chemistry Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831 (US)); Narten, A.H. *Journal of Chemical Physics (USA),* 91(7): 4299-4306 (1 Oct 1989). DOE Contract AC05-84OR21400;AC05-76OR00033.

X-ray diffraction data for liquid *n*-butane near the triple and boiling points are presented. The data are analyzed using scattering factors for $-CH_3$ and $-CH_2$ groups which permits extraction of structure and distribution functions for carbon sites. An intramolecular carbon–carbon distance at approximately 3.1 A is assigned to a short end-to-end distance in a near-*gauche* conformation, which is in agreement with the electron diffraction results for gaseous *n*-butane. The intermolecular pair distribution functions show a large difference in the liquid structure for the low and high temperature states, similar to that found in liquid propane.

3089 Molecular dynamics for discontinuous potential. IV. Lennard-Jonesium. Chapela, G.A. (Department of Chemical Engineering and Materials Science, University of Minnesota, 151 Amundson Hall, 421 Washington Avenue S.E., Minneapolis, Minnesota 55455 (US)); Scriven, L.E.; Davis, H.T. *Journal of Chemical Physics (USA),* 91(7): 4307-4313 (1 Oct 1989).

Argon, represented as a Lennard-Jones fluid, is simulated using a discontinuous version of the potential. The effect of discretization is thoroughly investigated in terms of the number of discontinuities and the cutoff diameter. Radial distribution functions, pressure, energy, self-diffusion coefficients, and velocity autocorrelation functions are used in order to evaluate this effect. A reduction of five times on computing time can be achieved by varying the cutoff radius and the number of discontinuities without much departure from the physical representation of Lennard-Jonesium atoms. The results indicate that discontinuous molecular dynamics is a viable alternative method to Monte Carlo and continuous molecular dynamics in simulating the properties of simple fluids.

3090 The bonding of acetonitrile and CH_2CN on Ag(110) determined by near edge x-ray absorption fine structure: Evidence for π-donor bonding and azimuthal ordering. Stevens, P.A. (Department of Applied Physics, Stanford University, Stanford, California 94305 (US)); Madix, R.J.; Stohr, J. *Journal of Chemical Physics (USA),* 91(7): 4338-4345 (1 Oct 1989).

Carbon *K* edge near edge x-ray absorption fine structure (NEXAFS) spectra of adsorbed acetonitrile and reactive intermediates derived therefrom on Ag(110) were studied in order to determine their orientation and bonding to the surface. For both the multilayer and the adsorbed monolayer there is excellent agreement between the spectra of the adsorbed acetonitrile and the gas phase species. For the multilayer coverage the orientation of the acetonitrile molecules is not completely random; the molecules prefer an orientation with their bond axes closer to parallel than perpendicular to the surface. At monolayer coverage acetonitrile bound to the surface is unrehybridized. It is bound with its linear molecular skeleton parallel to the surface and randomly oriented azimuthally. Annealing molecular CH_3 CN to 325 K in the presence of coadsorbed atomic oxygen produces a linear CH_2 CN surface intermediate, the molecular axis of which is parallel to the surface and perpendicular to the close-packed direction. The C–C and C–N bond lengths are essentially unperturbed from their values in gas phase CH_3 CN. Bonding appears to occur between the methylene carbon and the metal, as expected. A broadening of the π^* resonance for transition into the π^* orbital perpendicular to the surface is interpreted in terms of π-donor bonding.

3091 The reactions of iron clusters with water. Weiller, B.H. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Bechthold, P.S.; Parks, E.K.; Pobo, L.G.; Riley, S.J. *Journal of Chemical Physics (USA),* 91(8): 4714-4727 (15 Oct 1989). DOE Contract W-31-109-ENG-38.

The reactions of neutral iron clusters Fe_{7--27} with water are studied in a laser-vaporization cluster source coupled to a continuous-flow reactor. Reaction products are detected via laser ionization and time-of-flight mass spectrometry. The reactions of room-temperature clusters with H_2O show adsorbate decomposition and hydrogen desorption, as do the reactions with D_2O at elevated temperatures. The room-temperature reaction with D_2O appears not to involve any decomposition, and is at equilibrium under the conditions of these experiments. The dependence of reaction extent on D_2O pressure yields equilibrium constants for the addition of the first and second D_2O molecules. The analysis is complicated by the presence of two-photon ionization processes that are treated quantitatively with a rate-equation model. This treatment also yields estimates for cluster photoabsorption cross sections, which are found to be approximately linear in cluster size, having a magnitude of 2.3×10^{-17} cm^2 per iron atom. From the derived equilibrium constants and estimated adsorption entropies, approximate D_2O–cluster binding energies are determined. They range from 0.42 to 0.59 eV, and their dependence on cluster size shows a remarkable similarity to the dependence of the rate constants for reaction of iron clusters with H_2. The implications of this similarity are discussed.

3092 Dissociation energy of the molecule AlBr from equilibrium measurements. Hildenbrand, D.L. (SRI International, Menlo Park, California 94025 (US)); Lau, K.H. *Journal of Chemical Physics (USA),* 91(8): 4909-4911 (15 Oct 1989).

The dissociation equilibrium AlBr=Al+Br was studied by effusion beam mass spectrometry over the range 1970 to 2260 K and the dissociation energy D^0_0(AlBr) was derived as 4.41 ± 0.06 eV. This value is in general agreement with other fragmentary thermochemical results, but it is lower than a value derived from a short extrapolation of vibrational levels in the excited $^1\pi$ state, doubtless because of a potential maximum of about 0.22 eV in that state. A Birge–Sponer extrapolation of the ground state vibrational levels, when corrected for degree of ionicity, yields a D^0_0 value in close accord with the experimental result, but an electrostatic model calculation falls short by 0.45 eV.

3093 Self-diffusion on the Lennard-Jones fcc(111) surface: Effects of temperature on dynamical corrections. Cohen, J.M. (Theoretical Division (T-12, MS J569), Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Voter, A.F. *Journal of Chemical Physics (USA),* 91(8): 5082-5086 (15 Oct 1989).

Surface self-diffusion constants have been calculated for the single component Lennard-Jones fcc(111) system using the dynamical corrections formalism for transition state theory (TST). At high temperatures, these results are found to be in agreement with previous molecular dynamics calculations. Over the extended temperature range in which this method is valid, deviations from Arrhenius behavior are observed. At lower temperatures, a noticeable contribution to the diffusion constant stems from trajectories in which the adatom recrosses the TST boundary, often due to a direction-reversing collision with the substrate atom on the far side of the binding site. This produces a dip in the dynamical correction factor centered around a reduced temperature of T=0.038. At higher temperatures, the expected multiple-jump effects are observed.

3094 **The influence of adsorbate–absorbate hydrogen bonding in molecular chemisorption: NH_3, HF, and H_2O on Au(111).** Kay, B.D. (Sandia National Laboratories, Albuquerque, New Mexico 87175 (US)); Lykke, K.R.; Creighton, J.R.; Ward, S.J. *Journal of Chemical Physics (USA),* 91(8): 5120-5121 (15 Oct 1989). DOE Contract AC04-76DP00789.

Molecular beam and temperature programmed desorption (TPD) techniques are used to study the low temperature (85 K) adsorption and subsequent thermal desorption of NH_3, HF, and H_2O from Au(111). At 85 K the molecular sticking coefficients are near unity and are coverage independent. The TPD spectra are qualitatively different for the various species. Simple hydrogen bonding arguments based on absorbate–absorbate interactions are used to explain the differences in the TPD spectra.

4004 Electrochemistry

Refer also to citation(s) 2575, 2657, 3105

4005 Photochemistry

Refer also to citation(s) 2310, 2863, 3074

3095 (DOE/ER/13695–T1) **Laser photoelectron spectroscopy of ions: Progress report, 1988–1989.** Ellison, G.B. Colorado Univ., Boulder, CO (USA). Dept. of Chemistry and Biochemistry. Oct 1989. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13695. Order Number DE90002873. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We use photoelectron spectroscopy to study the properties of negative ions and radicals. The essence of our experiment is to cross a 0.6 keV mass-selected ion beam (M^-) with the output of a CW laser $\hbar\omega_0$. The resultant detached photoelectrons with kinetic energy, KE, are energy analyzed by means of a set of electrostatic hemispherical analyzers. Analysis of the photoelectron spectra enables us to extract molecular electron affinities, vibrational frequencies and electronic splittings of the final radical, M, as well as the relative molecular geometries of ions (M^-) and radicals (M). During the last three years we have completed the several studies: borane, amide, oxygen and nitric oxide, and ethylene and acetylene. We have also nearly completed a major overhaul of our photoelectron spectrometer that will permit us to prepare collisionally relaxed ions in a flowing afterglow ion source. 21 refs., 4 figs.

3096 (LBL–26906) **Photofragmentation of ketene to $CH_2(\tilde{X}^3B_1)$ + CO: Dissociation rate, energy release and exit barrier height.** Chen, I-Chia. Lawrence Berkeley Lab., CA (USA). Feb 1989. 116p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90002463. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Ketene cooled in a supersonic free jet is photolyzed in the ultraviolet range. The appearance rate of fragment CO from triplet ketene as a function of ultraviolet photon energy is measured by vacuum ultraviolet laser-induced fluorescence. A tunneling-corrected RRKM theory is used to fit the observed dissociation rate of ketene using the ab initio vibrational frequencies of the transition state. The rotational state distributions of CO from ketene photolyzed at 1120, 190, and 30 cm^{-1} above and at 50 cm^{-1} below the top of the barrier to dissociation on the triplet surface are measured. 25 refs., 17 figs., 9 tabs.

3097 **Ar^+_3 photodissociation and its mechanisms.** Chen, Z.Y. (Department of Chemistry, The Pennsylvania State University, University Park, Pennsylvania 16802 (US)); Albertoni, C.R.; Hasegawa, M.; Kuhn, R.; Castleman, A.W. Jr. *Journal of Chemical Physics (USA),* 91(7): 4019-4025 (1 Oct 1989).

The photodissociation spectrum of Ar^+_3 between 520 and 620 nm is reported. A broadband peaking near 520 nm is observed with a cross section of $\sim 1.8\times10^{-16}$ cm^2 at the peak, in agreement with the findings of Levinger *et al.* [J. Chem. Phys. **89**, 71 (1988)]. However, in the present work, a shoulder whose prominence is highly temperature dependent is observed between 545 and 555 nm. The new results are discussed in terms of various electronic transitions and pathways to dissociation. The photodissociation mechanisms are studied by translational energy analysis of photofragmentation. Three photodissociation mechanisms that involve two electronic energy surfaces are proposed which account for the experimental findings.

3098 **Dissociation of cyclohexene and 1,4-cyclohexadiene in a molecular beam.** Zhao, X. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720 (US)); Continetti, R.E.; Yokoyama, A.; Hintsa, E.J.; Lee, Y.T. *Journal of Chemical Physics (USA),* 91(7): 4118-4127 (1 Oct 1989). DOE Contract AC03-76SF00098.

Molecular-beam photofragmentation translational spectroscopy of cyclohexene and 1,4-cyclohexadiene was carried out using 193 nm and IR multiphoton excitation. At 193 nm, both the retro-Diels–Alder reaction of cyclohexene and H_2 elimination from both molecules were observed in the ground electronic state, indicating the occurrence of internal conversion from the initially excited electronic states. The retro-Diels–Alder reaction is shown to be concerted up to an internal energy higher than 148 kcal/mol. Hydrogen-atom elimination was also observed for both molecules following 193 nm excitation. The H atom is eliminated from an excited state of cyclohexene and is assigned to be from a carbon adjacent to the double bond, with a corresponding C–H bond energy of 87±3 kcal/mol. It is shown that the peak of the translational energy distribution for concerted dissociation in the ground state is determined mainly by the dynamics of the potential-energy release along the reaction coordinate, and is not sensitive to either the amount of internal energy or the form of excitation.

3099 **Two-dimensional spectroscopy: Theory of nonstationary, time-dependent absorption and its application to femtosecond processes.** Fain, B. (Department of Chemistry and Center for the Study of Early Events in Photosynthesis, Arizona State University, Tempe, Arizona 85287-1604 (US)); Lin, S.H.; Hamer, N. *Journal of Chemical Physics (USA),* 91(8): 4485-4494 (15 Oct 1989).

In this paper, we present a formalism for a generalized linear susceptibility applicable to femtosecond (fs) processes. As an application, we analyze the recent experimental results of the real-time fs transition spectra of the photodissociation of NaI and NaBr reported by Zewail *et al.* In this connection we also investigate in general the behaviors of decaying and trapping of the molecule in an excited electronic state coupled to a continuum.

3100 **A three-dimensional L^2 simulation of the photodetachment spectra of $ClHCl^-$ and IHI^-.** Gazdy, B. (Department of Chemistry, Emory University, Atlanta, Georgia 30322 (US)); Bowman, J.M. *Journal of Chemical Physics (USA),* 91(8): 4615-4624 (15 Oct 1989).

We report three-dimensional L^2 basis-set calculations of eigenvalues and eigenfunctions of ClHCl and IHI for zero total angular momentum. Comparisons are made to previous calculations of resonance energies and the bound state in IHI. These eigenfunctions are used in simulations of the photodetachment spectra of $ClHCl^- \rightarrow ClHCl + e^-$ and $IHI^- \rightarrow IHI + e^-$. The spectra are convoluted with Gaussian weight functions as was done in very recent simulations of Schatz, based on coupled-channel scattering calculations, and in the experiments of Neumark and co-workers.

4006 Radiation Chemistry

Refer also to citation(s) 2255, 2981, 3696

3101 Ionization yields in hydrocarbons under electron irradiation. Tung, C.J. (Brookhaven National Lab., Upton, NY (USA)); Baum, J.W. *Radiation Research (USA)*, 119(3): 413-423 (Sep 1989).

Ionization yields and W-values in several hydrocarbon gases under electron irradiation have been calculated using Inokuti's solution of the Fowler equation, i.e., incorporating a linear dependence of ionization yield on source electron energy. Collision stopping powers of hydrocarbons were evaluated using the Bethe formula with mean excitation energies determined using the additivity rule with modification based on molecular bond strengths. Contributions to the collision stopping powers from discrete level excitations were estimated by multiplying collision stopping powers by the excitation fractions constructed from atomic calculations. Average energy transfers for ionizing collisions producing subionization electrons were calculated using differential ionization cross sections proposed by Khare and co-workers. The calculated W-values are in good agreement with those recommended by ICRU.

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 2163, 2166, 3616, 3621, 3623, 3946

3102 (BNL–43464) **Cyclotron targetry for production of short-lived positron emitters.** Schlyer, D.J. Brookhaven National Lab., Upton, NY (USA). [1989]. 21p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC02-76CH00016. (CONF-890566–1: 5. symposium on the medical applications of cyclotrons and technical exhibition, Turku (Finland), 30 May - 2 jun 1989). Order Number DE90003253. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The basic concepts of cyclotron target design are presented along with the relevant practical experience gained by workers in this field over the years. Results are presented from several recent studies on the temperature and density distribution inside gas and liquid targets. 5 refs., 3 figs.

3103 (INIS-BR–1727) **Obtention of crystals feom thorium nitrate using microwave as heating source.** Aquino, A.R. de; Araujo, J.A. de; Abrao, A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90607851. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. THORIUM NITRATES/crystal-phase transformations; THORIUM NITRATES/drying; CHEMICAL COMPOSITION; MICROWAVE EQUIPMENT; DRYING

3104 (INIS-BR–1736) **Gastrin labelled at IPEN-CNEN/SP-Brazil. Comparison with a commercial tracer.** Ginabreda, M.G.P.; Borghi, V.C.; Bettarello, A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. Order Number DE90607940. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. GASTRIN/iodine 125; GASTRIN/radioimmunoassay; COMPARATIVE EVALUATIONS; GASTRIN; RADIOIMMUNOASSAY; LABELLED COMPOUNDS; QUALITY CONTROL

3105 Target and method for the production of fission product molybdenum-99. Vandergrift, G.F.; Vissers, D.R.; Marshall, S.L.; Varma, R. To Dept. of Energy, Washington, DC. USA Patent 4,839,133. 13 Jun 1989. Filed date 26 Oct 1987. USA Patent Application 7,112,158. 8p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a target for the reduction of fission product Mo-99. It is prepared from uranium of low U-235 enrichment by coating a structural support member with a preparatory coating of a substantially oxide-free substrate metal. Uranium metal is electrodeposited from a molten halide electrolytic bath onto a substrate metal. The electrode-position is performed at a predetermined direct current rate or by using pulsed plating techniques which permit relaxation of accumulated uranium ion concentrations within the melt. Layers of as much as to 600 mg/cm^2 of uranium can be prepared to provide a sufficient density to produce acceptable concentrations of fission product Mo-99.

4008 Combustion, Pyrolysis, and High-temperature Chemistry

Refer also to citation(s) 3377

3106 (AD-A–210841/3/XAB) **Evolution of reaction center in an explosive material.** Jackson, T.L.; Kapila, A.K.; Stewart, D.S. Rensselaer Polytechnic Inst., Troy, NY (USA). Apr 1989. 29p. Available from NTIS, PC A03/MF A01.

Pub. in SIAM Jnl. of Applied Mathematics, Vol. 49, No. 2, 432-458(Apr 1989).

Experimental observations of ignition in explosive systems demonstrate that, as a rule, combustion first sets in at small, discrete sites where inherent inhomogeneities cause chemical activity to proceed preferentially and lead to localized explosions. Combustion waves propagating away from these 'reaction centers' eventually envelop the remaining bulk. This study examines the spatial structure and temporal evolution of a reaction center for a model involving Arrhenius kinetics. The center, characterized by peaks in pressure and temperature with little diminution in local density, is shown to have one of two possible self-similar structures. The analysis employs a combination of asymptotics and numerics, and terminates when pressure and temperature in the reaction center have peaked.

3107 (DOE/ER/13471–T2) **Kinetics data base for combustion modeling: Status report, February 1, 1988–January 31, 1989.** Herron, J.T.; Tsang, W. National Bureau of Standards, Washington, DC (USA). Chemical Kinetics Div. 8 Jul 1988. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AI01-86ER13471. Order Number DE90003095. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Work carried out at the National Bureau of Standards for the Basic Energy Sciences Division of the Department of Energy under Interagency Agreement A101-76PRO6016, Task Order No. 007, Amendment No. 5, "Kinetic Data Base for Combustion Modeling" is summarized. By the end of the present contract year, recommended values will be provided for the elementary chemical reactions of trans-2-butene and the allyl radical with the species in the existing data base. The total number of elementary interactions which will be evaluated will exceed 1020. The data compilation part of the program is essentially current and the total number of reactions covered now exceeds 2500. 5 refs.

3108 (LBL–27904) **A tomographic study of premixed turbulent stagnation point flames.** Shepherd, I.G.; Cheng, R.K.; Goix, P. Lawrence Berkeley Lab., CA (USA). Oct 1989. 11p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. F-44620-76-C-0083. (CONF-8910289–2: Western States Section meeting of the Combustion Institute, Livermore, CA (USA), 23-24 Oct 1989). Order Number DE90002462. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The high speed tomographic technique has been used to study premixed flame propagation in stagnation flow stabilized flames. Studies are performed on CH4/Air and C2H4/Air flames with equivalence ratios ranging from 0.75 to 1.0. The gas velocity at the nozzle exit is 5 m/s, the turbulence intensity is varied from 5% to 7% and the turbulence Reynolds number is 70. The light source is a copper vapor laser which produces 20ns, 5 mJ pulses at a 4KHz repetition rate. Cylindrical lenses transform the 38 mm circular laser beam to a sheet 50 mm high and 0.6 mm thick. A high speed Fastax camera is used to record the tomographic images. The films are digitized and the flame front extracted from the images by a threshholding technique. A fractal analysis was performed on the flame boundaries in order to characterize the flame geometry and provide an estimate of the flame surface area. The flame area increase was found to give a reasonable estimate of the burning rate when compared with other methods if the effects of flow tube divergence were considered. Characteristic wrinkle sizes were found to be much larger than the length scales of the turbulence in the reactant stream. 8 refs., 5 figs., 2 tabs.

3109 (LBL–27916) **Molecular beam studies of oxygen atom reactions with unsaturated hydrocarbons.** Schmoltner, A.-M. Lawrence Berkeley Lab., CA (USA). Oct 1989. 295p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90003124. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

The dynamics of several elementary reactions relevant to combustion was investigated. The reactive scattering of ground state oxygen atoms with small unsaturated hydrocarbons was studied using a crossed molecular beam apparatus with a rotatable mass spectrometer detector. The infrared and ultraviolet photodissociation of anisole was studied using a rotating beam source/fixed detector apparatus. 253 refs., 64 figs., 4 tabs.

3110 (NEI-DK–215) **Development of a data-processing model for steady turbulent 3-D gas particle flow.** Energiministeriets Energiforskningsprogram. Braendsler og forbraendingsteknik. Olsen, A.; Astrup, P.; Dall, H.; Gjernes, E.; Hadvig, S.; Toerslev Jensen, P.; Kampp Rasmussen, N.B. Risoe National Lab., Roskilde (Denmark); Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. May 1989. 370p. (In Danish, English). Order Number DE90718997. Available from NTIS (US Sales Only), PC A16/MF A01.

Energiministeriets Energiforskningsprogram. Braendsler og forbraendingsteknik.; EFP-85. Consist of 8 papers.

The project "Development of a data processing model for steady turbulent 3-D gas-particle flow" was carried out in collaboration with the Laboratory for Heating and Indoor Climate Technology at the Technical University of Denmark and the Heating Technology Section of the Energy Technology Department at Risoe National Laboratory. The basis for the project is described, as are methods used and the results achieved. The seven partial reports are included in their unmitigated versions. Transport of gas mixed with particles is inevitable in many industrial processes particularly where pulverized coal is used as fuel. The particles can cause damage to components, such as erosion on turbine blades etc., and their contribution to the extent of air pollution is significant. It is important to be able to measure and predict the extent of gas-particle flow in boilers, and the aim of this project was to develope computerized simulations and computer programs in order to achieve this goal. (AB).

3111 (NEI-DK–215, pp. 1-8) **Note on improved k-ϵ turbulent flow model.** Kampp Rasmussen, N.B. (DTH, Lab. for Varme- og Klimateknik (DK)). Risoe National Lab., Roskilde (Denmark); Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. May 1989. (In Danish). In *Development of a data-processing model for turbulent 3-D gas particle flow.* Order Number DE90718997. Available from NTIS (US Sales Only), PC A16/MF A01.

Energiministeriets Energiforskningsprogram. Braendsler og forbraendingsteknik.; EFP-85. Consists of 8 papers.

Improvements on the k-ϵ turbulent flow model for data processing are illustrated by equations. (AB).

3112 (NEI-DK–215, pp. 1-44) **User manual and program documentation for the "TUFCA" flow program.** Kampp Rasmussen, N.B. (DTH, Lab. for varme- og klimateknik (DK)). Risoe National Lab., Roskilde (Denmark); Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. May 1989. (In Danish). In *Development of a data-processing model for turbulent 3-D gas particle flow.* Order Number DE90718997. Available from NTIS (US Sales Only), PC A16/MF A01.

Energiministeriets Energiforskningsprogram. Braendsler og forbraendingsteknik.; EFP-85. Consists of 8 papers.

The program measures the unknown variable, velocity, pressure, turbulence as well as temperatures and concentrations for a turbulent flowing medium in 3 dimensions. The manual offers practical advice on hardware and instructions on how to use the program in addiction to an explanation of the principles on which it is based. (AB).

3113 (NEI-DK–215, pp. 1-31) **Numerical integration method of radiative exchange (NIMREX).** Kampp Rasmussen, N.B. (Technical University of Denmark, Laboratory of Heating and Air Conditioning (DK)); Toerslev Jensen, P.; Hadvig, S. Risoe National Lab., Roskilde (Denmark); Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik. May 1989. In *Development of a data-processing model for turbulent 3-D gas particle flow.* Order Number DE90718997. Available from NTIS (US Sales Only), PC A16/MF A01.

Energiministeriets Energiforskningsprogram. Braendsler og forbraendingsteknik.; EFP-85. Consists of 8 papers.

A method for calculating thermal radiation using a quite new concept, the NIMREX model, is presented. The governing differential equations of thermal radiation are integrated by a method of numerical integration known from finite element methods. Theoretically the model is exact and can be brought to an arbitrary level of accuracy for an optical thickness from zero to infinity. For test purpose a FORTRAN code has been constructed. Based on a 1% accuracy level the NIMREX model is faster than a Monte Carlo zone (MCZ) method, except for the optically thin case. The two methods agree except in the optically thick case where the NIMREX model agrees with exact solutions of the diffusion method, while the MCZ method disagrees. (author).

3114 (PB–89-231617/XAB) **Enhanced flame stability and soot radiation using electric fields. Final report, July 1986-January 1989.** Berman, C.H.; Gill, R.J.; Calcote, H.F. AeroChem Research Labs., Princeton, NJ (USA). Jun 1989. 15p. (AEROCHEM-TP–484). Available from NTIS, PC A03/MF A01.

See also PB–89-140883.

Enhanced stabilization of methane-air flames was achieved by application of dc electric fields of only a few thousand volts with a minimum electric power dissipation, about 0.01% of the combustion power being controlled. Both the lean-blowoff composition and the maximum blowoff velocity are markedly affected. The mechanism for the phenomenon is discussed in terms of an effect of the electric field on the boundary velocity gradient. The electric field applies an electric force on the chemiions in the flame, producing an electric wind that forces the flame closer to the burner rim both reducing the dead space and decreasing the boundary velocity gradient. The boiling effect on a flat flame due to the application of an electric field, reported previously, is explained by an electron cascade effect in which thermally produced electrons are accelerated by the electric field producing more charged soot particles. In a counterflow flame, periodic waves are produced by the electric field; an explanation has not been developed. The counterflow and flat flame apparatus, including the laser optical system for particle measurements in the flame has been completely redesigned for more rapid and especially more accurate data collection.

3115 (VTT-TUTK–622) **Combustion of fixed-bed in grate firing.** Koistinen, R. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Jun 1989. 106p. (In Finnish). Order Number DE90719334. Available from NTIS (US Sales Only), PC A06/MF A01.

This study considers the basic phenomena that characterize fixed-bed combustion. The experimental and theoretical results reported and compared here deal with grate boilers in particular. The study begins with considerations of single fuel particles, and proceeds then to different kinds of fixed-bed firing in both laboratory and full scale conditions. As a whole, the nature of these considerations is very practical. The burning rate of peat and wood fuels with high moisture content is primarily limited by speed of fuel drying and pyrolysis (flame spread rate). The radiation heat transfer is of very great importance in cases where the bed is thin and the furnace surfaces as a whole are refractory-lined. Preheating of combustion air has a considerable impact on combustion, if the air temperature is sufficiently high (200-300 deg C) and if the mass flow of air is big enough. In grate-furnaces (crossfeed type) firing wood and peat the burning rate varies between 0.3-1.0 MW/m^2 depending on the moisture content of fuel. An increase of the width-to-length ratio of the grate promotes burning rate per unit area. In pure overfeed combustion the burning rate per unit grate area can reach 1.4-1.6 MW/m^2. The overfeed structure is less expensive than the crossfeed one. In the overfeed principle high burning rates can be reached with relatively small primary air flow. The burning rate is restricted only by velocity and mass flow of primary air. In the overfeed firing the high temperature in the coke layer is a problem and ash can easily melt on the grate.

3116 Laser-induced-fluorescence spectroscopy of jet-cooled C_3. Rohlfing, E.A. (Combustion Research Facility, Sandia National Laboratories, Livermore, California 94551 (US)). *Journal of Chemical Physics (USA)*, 91(8): 4531-4542 (15 Oct 1989).

We present a spectroscopic study of jet-cooled C_3 in which laser-induced-fluorescence (LIF) excitation spectra and dispersed-fluorescence (DF) spectra are taken for a new, vibronically induced band system ($^1\Pi_g$ and/or $^1\Delta_u$)–$\tilde{X}\ ^1\Sigma^+_g$ in the ultraviolet. In addition, DF spectra are taken for the well-known cometary band system, $\tilde{A}\ ^1\Pi_u$–$\tilde{X}^1\Sigma^+_g$. The DF spectra of the new system are very rich and display strong fluorescence bands in stretch–bend progressions that reach as high as 17 000 cm^{-1} in the $^1\Sigma^+_g$ ground state. The data from the DF spectra of both systems is used to assign vibrational term energies to 144 ground-state levels that cover the range: $0 \leq v_1 \leq 8$, $0 \leq v_2 \leq 37$, and $0 \leq v_3 \leq 4$. The observed level structure clearly demonstrates the highly anharmonic nature of the potential energy surface of C_3 and the unusual internal dynamics that occurs upon it. These include pronounced barriers to linearity in the v_3=2 and v_3=4 states and an increase in molecular rigidity as the symmetric stretch is excited.

42 ENGINEERING

Refer also to citation(s) 2977

4202 Facilities and Equipment

Refer also to citation(s) 2170, 2173, 2174, 2189, 2263, 2432, 2612, 2695, 2709, 2917, 3213, 3232, 3320, 3327, 3806, 3898, 4472, 4473, 4478, 4514, 4523

3117 (AD-A–210345/5/XAB) **Composite ceramic superconducting wires for electric-motor applications. Annual report No. 1, 30 June 1988-30 June 1989.** Holloran, J.W. Casazza, Schultz and Associates, Inc., Arlington, VA (USA). 7 Jul 1989. 189p. (CPS–89-009). Available from NTIS, PC A09/MF A01.

This report describes progress on developing Y-123 wire for an HTSC motor. The wire development involves synthesis of Y-123 powder, spinning polymer-containing green fiber, heat treating the fiber to produce metallized superconducting filaments, and characterizing the electrical properties. A melt spinning process was developed for producing 125-micron-diameter green fiber containing 50 vol% Y-123. This fiber can be braided for producing transposed multifilamentary wire. A process was developed to coat green fiber with silver alloys which can be continuous sintering. A second process for multifilamentary ribbon wire is also being developed. The Y-123 filaments have 77 deg self-field Jc values up to 2600 A/sq cm, but Jc is reduced to 10 A/sq cm at 800 G. Preliminary data are presented on mechanical properties. A DC homopolar motor with an iron magnetic circuit is being designed to operate with early HTSC wire.

3118 (AD-A–210726/6/XAB) **Frequency dependence of quasi-particle mixers.** Danchi, W.C.; Sutton, E.C. California Univ., Berkeley, CA (USA). 1 Dec 1986. 12p. Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 60, No. 11, 3967-3977(1 Dec 1986).

Since the publication of the original theoretical work on superconductor-insulator-superconductor (SIS) tunnel-junction quasi-particle mixers by Tucker, theoretical attention has largely focused on understanding the physical origin of gain (conversion efficiency greater than unity) in the mixer, the conditions for mixer saturation and the behavior of series arrays of junctions. This work is applicable to frequencies generally much less than the frequency corresponding to the superconducting energy gap. The analysis reported here primarily differs from previous work in that analytic approximations to the quantum mixer theory of Tucker are developed that allow one to derive simple power-law expressions for mixer conversion efficiency and noise temperature due to shot noise over the complete frequency range. These approximations allow one to have a qualitative understanding of frequency-dependent effects in quasi-particle mixers.

3119 (AD-A–210860/3/XAB) **Inverse a-c Josephson effect at terahertz frequencies.** Danchi, W.C.; Golightly, W.J.; Sutton, E.C. California Univ., Berkeley, CA (USA). 1 Apr 1989. 16p. Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 65, No. 7, 2772-2786(1 Apr 1989).

The inverse a-c Josephson effect occurs when a Josephson junction driven by a microwave source of frequency f produces constant-voltage steps at integer multiples of hf/2e. For low leakage current, hysteretic junctions driven at microwave frequencies below about 100 GHz, some of these steps can cross the zero dc bias current axis. These zero-crossing steps allow modern-series array-voltage standards to operate without individually biasing the junctions in the array. The authors r-eexamine the theory behind these steps and show that they can exist at frequencies much higher than thought previously; the Riedel singularity in the supercurrent response allows this effect to exist even up to terahertz frequencies. They describe a set of analytical calculations that provide limits on the amount of rounding of the Riedel Peak that can be permitted while still allowing these zero-crossing steps to occur. They also discuss practical considerations such as microwave power levels required and parameters for device fabrication. This analysis is supported by numerical frequency-domain computations and time-domain simulations for a number of realistic I-V curves with rounded Riedel singularities and with quasi-particle subgap leakage currents.

3120 (AD-A–210988/2/XAB) **Effect of twins on critical currents of high T_c superconductors. Interim report No 4.** Campbell, A.M.; Ashby, M.F. Cambridge Univ. (UK). 1989. 4p. Available from NTIS, PC A02/MF A01.

The initial work on levitation forces and separation of superconducting powders has divided into two projects. The first is the nature of the frictional forces and damping on levitated magnets. Although it is reasonable to suppose this arises from AC losses in the superconductor, magnets rotating about their centre of symmetry should not give fluctuating fields and should form almost frictionless bearings. The second is the direct use of magnetic forces to separate particles of superconducting from non-superconducting material. The major problem here has been the tendency of fine particles to stick together due to electrostatic forces. To overcome this, the authors formed a slurry of the material in liquid nitrogen and flash evaporated the nitrogen to blow particles apart. This was reasonably successful but they do not yet know to what extent they will reagllomerate. A second problem is ensuring thermal equilibrium of the particles. This can be done fairly easily in a liquid slurry, but this limits the useful temperature range and the liquid convection tends to counteract the separation process.

3121 (AD-A–211246/4/XAB) **Physics and materials science of high-temperature superconductors. Final report.** Rossowsky, R.; Methfessel, S. Pennsylvania State Univ., University Park, PA (USA). Applied Research Lab. 26 Aug 1989. 165p. Available from NTIS, PC A08/MF A01.

This report contains the conference program, a list of the abstracts of papers, the poster session abstracts and a list of the participants. The program stressed the physics and materials science of high-temperature superconductors. Subjects covered include: Superconductivity; Superconductive materials; Superconductive ceramics; Magnetic fields; Electrical resistivity; Thermoelectric power measurements; Crystal chemistry; Antiferromagnetic instabilities; Microstructures; Thin films; Electronic structure; Thermodynamics; Critical current density; Grain-boundary chemistry; Oxygen and ion doping; Proximity effect; Superconductor wires; and Epitaxial thin films.

3122 (AEEW-M–2496) **Method for predicting the impact velocity of a projectile fired from a compressed air gun facility.** Attwood, G.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Mar 1988. 87p. Order Number DE90608623. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

This report describes the development and use of a method for calculating the velocity at impact of a projectile fired from a compressed air gun. The method is based on a simple but effective approach which has been incorporated into a computer program.

The method was developed principally for use with the Horizontal Impact Facility at AEE Winfrith but has been adapted so that it can be applied to any compressed air gun of a similar design. The method has been verified by comparison of predicted velocities with test data and the program is currently being used in a predictive manner to specify test conditions for the Horizontal Impact Facility at Winfrith. (author).

3123 (AEEW-M–2520) **Three-dimensional effects in flask impact testing.** Cooper, C.A.; Neilson, A.J.; Butler, N.; Bazell, C.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. May 1988. 24p. (CONF-8805340–: 1. international conference on transportation for the nuclear industry, Stratford-upon-Avon (UK), 23-25 May 1988). Order Number DE90608625. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A programme of generic impact experiments is being carried out at AEE Winfrith on idealised models of monolithic spent fuel transport flasks. The objectives of the programme is to validate the use of finite element computer codes for the assessment of the performance of these flasks in impact accidents. The computer codes used in the pre-and post-test analyses are HONDO-II (axisymmetric geometries) and DYNA3D (3-dimensional geometries). Both these codes are operational on the UKAEA CRAY computer, thus allowing a direct comparison to be made of the relative cost as well as the accuracy of the simulations. The paper discusses the comparison between the results of pre-test calculations using the HONDO-II code and test measurements for nominally perpendicular impacts of the lid-end of unprotected flasks on a steel-faced block. The observed effects of slightly off-normal impacts are described and are compared with post-test calculations using the DYNA3D code. (author).

3124 (AEEW-R–2033) **Gas velocity measurements in purged port posting systems.** Smith, D.I.; Hollick, R.C. UKAEA Atomic Energy Establishment, Winfrith (UK). Materials Technology Div.; Department of the Environment, London (UK). Feb 1986. 28p. (DOE-RW–88.045). Order Number DE90608626. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A hot film anemometer has been used to measure gas velocities around symmetrical and asymmetrical annular gaps designed to simulate the purged gap in a posting port. The results have been shown to agree with simple theory. Measurement will therefore provide a convenient in-service inspection method and the results have enabled recommendations to be made on manufacturing tolerances which will ensure that predicted gas velocities around purged seals will be maintained. (author).

3125 (CONF-891103–44) **Subcriticality of two uranyl nitrate slab tanks spaced in air by the ^{252}CF-source-driven noise analysis method.** Mihalczo, J.T.; Blakeman, E.D.; Pare, V.K. Oak Ridge National Lab., TN (USA). 14 Aug 1989. 16p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE90003067. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As with previous experiments with loosely coupled systems, point kinetics interpretation can be used to obtain neutron multiplication factors if the californium source and detectors are located on the same tank. Although the californium source is located asymmetrically in the system the detectors were sufficiently far apart that the correlated information was from long fission chains which are more nearly fundamental-mode distributed. Examination of the experimental data before interpretation allows an assessment of the applicability of point kinetics. The subcritical neutron multiplication factor for the two tanks has been measured out to separations in air of 57.9 cm, and calculations agree with the experimental results. These experiments confirmed the criteria from previous experiments for location of source and detector to allow point kinetics interpretation of the data. For source detector locations for which point kinetics is not applicable, the theory of Difillippo can be used to obtain the neutron multiplication factor from the ratio of spectral densities. 18 refs., 3 figs., 2 tabs.

3126 (EGG-HFRU–8654) **Human factors evaluation of electroluminescent display #1.** Auflick, J.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). Aug 1989. 18p. Sponsored by U.S. Department of Defense. DOE Contract AC07-76ID01570. Order Number DE90002231. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report consists of an an electroluminescent display, done by scientists and researchers in the Human Factors Research Unit at EG&G, Idaho, Inc. The purpose of this evaluation was to examine the "Sunlight Readability" of one electroluminescent (EL) display; a display which may be incorporated into a new generation of US Army diesel generators. The basic finding of this evaluation is that this particular EL display is not sunlight readable. 2 figs., 10 tabs.

3127 (EGG-M–88271) **Model for measuring complex performance in an aviation environment.** Hahn, H.A. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881058–5: Human Factors Society annual meeting, Anaheim, CA (USA), 24-28 Oct 1988). Order Number DE90002055. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An experiment was conducted to identify models of pilot performance through the attainment and analysis of concurrent verbal protocols. Sixteen models were identified. Novice and expert pilots differed with respect to the models they used. Models were correlated to performance, particularly in the case of expert subjects. Models were not correlated to performance shaping factors (i.e. workload). 3 refs., 1 tab.

3128 (LA-UR–89-3331) **Rf superconductivity research and development at Los Alamos National Laboratory.** Cooke, D.W.; Gray, E.R.; Houlton, R.J.; Lawrence, G.P.; McGill, J.A.; Meyer, E.; Morris, C.; Rusnak, B.; Starke, T.P. Los Alamos National Lab., NM (USA). 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8908145–4: 4. workshop on RF superconductivity, Ibaraki-Ken (Japan), 14-18 Aug 1989). Order Number DE90002440. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Los Alamos National Laboratory is engaged in two distinct areas of rf superconductivity research and development. One program is devoted to studying the rf properties of high-temperature superconductors (HTS) and assessing their potential for accelerator-cavity applications. Our best results to date have come from $YBa_2Cu_3O_7$ films (0.8 μm) electron-beam deposited onto $LaGaO_3$ substrates. A typical surface resistance value is 0.2 $\pm$ 0.1 mΩ measured at 22 GHz and 4 K, which is only a factor of 2–4 higher than Nb. A second area of rf superconductivity R&D at Los Alamos involves fabricating and testing conventional Nb superconducting rf cavities. Facilities are being constructed for polishing, cleaning,and testing both small (3-GHz) and large (805-MHz) Nb cavities. Much of our effort is being devoted to understanding the proper techniques for welding, cleaning, and handling Nb cavities, to ensure good high-field performance. Nb cavity applications are foreseen in upgrades to LAMPF, compact free-electron lasers, and high-current cw proton linacs. A single 402.5-MHz Nb cavity (in a beam cryostat) is presently being acquired from industry to provide a momentum compactor for the low-energy pion beam at LAMPF. 6 refs., 3 figs.

3129 (LBL–27627) **Review of SC/RF refrigeration systems.** Byrns, R.A. Lawrence Berkeley Lab., CA (USA). Aug 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8908145–5: 4. workshop on RF superconductivity, Ibaraki-Ken (Japan), 14-18 Aug 1989). Order Number DE90002460. Available from NTIS, PC A03/MF A01 - OSTI.

A short review is given of historical events in accelerator and cryogenic developments at both Stanford and Berkeley. Methods of refrigeration between 1.85 K and 4.5 K together with modern techniques and improvements are discussed. Where the decade of the 70's was the era of the screw compressor, the 80's can be considered that of the cold vacuum pump for superfluid cooling. Distribution methods are of major importance, and arguments can be made for bath or tube cooling, two-phase, thermo-syphon, supercritical or superfluid. System design affects reliability, safety and operating stability. Distribution costs and heat loads can be a large part of system totals. Some specific system descriptions are included. 18 refs., 20 figs., 2 tabs.

3130 (LBL–27746) **Retractable gas cooled leads for ASTROMAG.** Pope, W.L.; Green, M.A. Lawrence Berkeley Lab., CA (USA). Jul 1989. 8p. Sponsored by U.S. DOE Energy Research; National Aeronautics and Space Administration. DOE Contract AC03-76SF00098. (CONF-890701–19: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90002679. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses retractable gas cooled leads for the ASTROMAG experiment superconducting solenoid which will operate on the space station. The ASTROMAG magnet will be cooled by superfluid helium pumped from a storage tank by a fountain effect pump. Since it is desirable to keep the helium consumption low, retractable gas cooled leads are proposed for the ASTROMAG magnet. These leads, which will be in the cryostat vacuum space, will connect directly with the helium flow circuitry which cools the magnet. The leads will operate in a flow circuit separated from the shields. 10 refs., 6 figs.

3131 (LBL–27826) **Design and testing of a superfluid liquid helium cooling loop.** Gavin, L.M.; Green, M.A.; Levin, S.M.; Smoot, G.F.; Witebsky, C. Lawrence Berkeley Lab., CA (USA). Jul 1989. 8p. Sponsored by U.S. DOE Energy Research; National Aeronautics and Space Administration. DOE Contract AC03-76SF00098. NAG5-1123. (CONF-890701–20: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90002328. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper describes the design and preliminary testing of a cryogenic cooling loop that uses a thermomechanical pump to circulate superfluid liquid helium. The cooling loop test apparatus is designed to prove forced liquid helium flow concepts that will be used on the Astromag superconducting magnet facility. 3 refs., 2 figs.

3132 (NUREG–0383-Vol.3-Rev.9) **Directory of certificates of compliance for radioactive materials packages: Report of NRC approved quality assurance programs for radioactive materials packages: Volume 3: Revision 9.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation. Oct 1989. 199p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A10/MF A01 - GPO; OSTI; INIS.

The purpose of this directory is to make available a convenient source of information on packaging which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance Number is included at the front of Volume 2 of the directory. A listing by packaging types is included in the back of Volume 2. An alphabetical listing by Company name is included in the back of Volume 3 for approved QA programs. The Reports include a listing of all users of each package design and approved QA programs prior to the publication date of the directory.

3133 (PB–89-228308/XAB) **Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering center programs, January-March 1989, with 1989 CEEE events calendar.** Walters, E.J. National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Electronics and Electrical Engineering. Jul 1989. 20p. (NISTIR–89/4118). Available from NTIS, PC A03/MF A01.

See also PB–89-209241.

This report is the twentieth issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. The issue covers the first quarter of calendar year 1989. Abstracts are provided by technical area for papers published during the quarter.

3134 (PB–89-872006/XAB) **Hydrodynamic journal bearings: Capacity, wear, and lubrication. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 137p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868484.

This bibliography contains citations concerning the characteristics of hydrodynamic journal bearings. Bearing load, lubrication, thermal effects, tolerance to misalignment, cavitation, and design are discussed. Studies on the effect of temperature and heat transfer on hydrodynamic films are presented. The impact of surface roughness on hydrodynamic journal bearing performance is also examined. (This updated bibliography contains 359 citations, 27 of which are new entries to the previous edition.)

3135 (PB–89-872055/XAB) **Lubricants and greases: Properties and evaluation. January 1973-April 1988 (Citations from Fluidex data base). Report for January 1973-April 1988.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 90p. Available from NTISPC N01/MF N01.

See also PB–89-872063.

This bibliography contains citations concerning properties characterization, additives, rheological studies, and the utilization of a variety of lubricants, including synthetic oils and greases. Bearing and seal lubricants are discussed, and lubricant testing methods are described. Some attention is given to specific applications in industry. (This updated bibliography contains 287 citations, none of which are new entries to the previous edition.)

3136 (PB–89-872063/XAB) **Lubricants and greases: Properties and evaluation. May 1988-September 1989 (Citations from Fluidex data base). Report for May 1988-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 69p. Available from NTISPC N01/MF N01.

Supersedes PB–88-863261. See also PB–89-872055.

This bibliography contains citations concerning properties characterization, additives, rheological studies, and the utilization of a variety of lubricants, including synthetic oils and greases. Bearing and seal lubricants are discussed. and lubricant testing methods are described. Some attention is given to specific applications in industry. (This updated bibliography contains 200 citations, all of which are new entries to the previous edition.)

3137 (RISO-M–2801) **CROSS SECTION. Program description and user manual.** Jeppesen, B.; Krenk, S. Risoe National Lab., Roskilde (Denmark). Jul 1989. 28p. Order Number DE90719291. Available from NTIS (US Sales Only), PC A03/MF A01.

The FORTRAN program CROSS-SECTION calculates the properties of an elastic beam cross section. This manual gives a brief summary of the notation and principles, a description of the program structure, a user manual for the input, and an example illustrating the input and output structure. (author) 1 tab., 6 ills., 3 refs.

3138 (SAND–89-0319C) **Autonomous land navigation in a structured environment.** Klarer, P.R. Sandia National Labs., Albuquerque, NM (USA). [1989]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8911102–1: IEEE international conference on systems, man and cybernetics, Cambridge, MA (USA), 14-17 Nov 1989). Order Number DE90001625. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes a hardware and software system developed to perform autonomous navigation of a land vehicle in a structured environment. The vehicle used for development and testing of the system was the Jeep Cherokee Mobile Robotics Testbed Vehicle developed at Sandia National Laboratories in Albuquerque. Since obstacle detection and avoidance have not yet been incorporated into the system, a structured environment is postulated that presumes the paths to be traversed are free of obstacles. The system performs path planning and execution based on maps constructed using the vehicle's onboard navigation system and mapmaker. The system software, hardware, and performance data are discussed. 6 refs.

3139 (SAND–89-1485) **An experimental investigation of wall-interference effects for parachutes in closed wind tunnels.** Macha, J.M.; Buffington, R.J. Sandia National Labs., Albuquerque, NM (USA). Sep 1989. 25p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC04-76DP00789. Order Number DE90001802. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A set of 6-ft-diameter ribbon parachutes (geometric porosities of 7%, 15%, and 30%) was tested in various subsonic wind tunnels

covering a range of geometric blockages from 2% to 35%. Drag, base pressure, and inflated geometry were measured under full-open, steady-flow conditions. The result drag areas and pressure coefficients were correlated with the bluff-body blockage parameter (i.e., drag area divided by tunnel cross-sectional area) according to the blockage theory of Maskell. The data show that the Maskell theory provides a simple, accurate correction for the effective increase in dynamic pressure caused by wall constraint for both single parachutes and clusters. For single parachutes, the empirically derived blockage factor K_M has the value of 1.85, independent of canopy porosity. Derived values of K_M for two- and three-parachute clusters are 1.35 and 1.59, respectively. Based on the photometric data, there was no deformation of the inflated shape of the single parachutes up to a geometric blockage of 22%. In the case of the three-parachute cluster, decreases in both the inflated diameter and the spacing among member parachutes were observed at a geometric blockage of 35%. 11 refs., 9 figs., 3 tabs.

3140 (UCRL–100641) **Inductive store opening switch and tests for energy transfer to a load.** Poulsen, P.; Cutting, J.L.; Hawke, R.S.; McAlice, A.J.; Pincosy, P.A.; Chase, J.B. Lawrence Livermore National Lab., CA (USA). 12 Oct 1989. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890710–24: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989). Order Number DE90002818. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Power from the output of an explosive generator can be quickly and efficiently switched by transformer-coupled circuits with a fuse as the switching element. Numerical studies indicate that this technique should be able to switch 2 MA of current into a resistive load of 20 Ω in 100 ns or less, producing in the load a near steady-state pulse with a duration of 1 μs about 100 ns after the switching begins. We report in this paper the results of ongoing experiments to create a fuse with a short switching time (about 100 ns), a high resistance ratio (approximately 300), and adequate voltage holding characteristics. We found that a tamper consisting of both Mylar and SiO grease substantially increases both the resistance ratio of a fuse, and the length of time a high resistance ratio is maintained, relative to what is observed in fuses tamped with Mylar alone. 2 refs., 7 figs.

3141 **Continuous cryopump with a method for removal of solidified gases.** Carlson, L.W.; Herman, H. To Dept. of Energy, Washington, DC. USA Patent 4,838,035. 13 Jun 1989. Filed date 5 May 1988. USA Patent Application 7,190,567. Int. Cl. B01D 8/00. 6p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an improved cryopump for the removal of gases from a high vacuum. It's comprised of a cryopanel incorporating honeycomb structure, refrigerant means thermally connected to the cryopanel, and a rotatable channel moving azimuthally around an axis located near the center of the cryopanel, removing gases absorbed within the honeycomb structure by subliming them and conducting them outside the vacuum vessel.

4203 Lasers

Refer also to citation(s) 3020, 3272, 3298, 3312, 3313, 3900, 3901, 4366, 4370, 4453, 4481

3142 (AD-A–210613/6/XAB) **Multiline multimode c-w (continuous-wave) chemical laser performance. Technical report.** Mirels, H. Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab. 1 Jul 1989. 44p. (TR–0088(3907)-1). Available from NTIS, PC A03/MF A01.

Effects of translational rotational nonequilibrium large-scale c-w chemical laser performance are evaluated for the case of a Fabry-Perot resonator with multiple longitudinal modes. Numerical results are presented for the limit Delta nu Sub c << Delta nu sub h << Delta nu sub d, where Delta nu sub c, Delta nu sub h, and Delta nu sub d denote longitudinal mode separation, homogeneous width, and Doppler width, respectively. Results include the effect of threshold gain on the power in each longitudinal mode, the power associated with each rotational energy level, and the net laser power. In the case of a saturated laser, an increase of threshold gain results in an increase in the output from strong rotational transitions at the expense of the output from weak rotational transitions. Total output is reduced. With further increase of threshold gain, the output from all rotational transitions is reduced. The case of rotational nonequilibrium and translational equilibrium is also considered. The latter case, a common assumption, is shown to provide net output power that is intermediate between the values for rotational and translational equilibrium and for rotational and translational nonequilibrium.

3143 (AD-A–210706/8/XAB) **300-Watt dye laser for field experimental site.** Everett, P.N. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 1988. 8p. (MS–7997). Available from NTIS, PC A02/MF A01.

Pub. in Proceedings of the International Conference on Lasers '88, 404-409(1988).

A 6-beam flashlamp-pumped dye-laser system is being installed at a field site. Each beam will produce 5 to 10 Joules in 2-microsec pulses at 10 pps. Design, installation, and initial performance will be reviewed.

3144 (AD-A–210708/4/XAB) **Efficient nonlinear conversion of laser-diode-pumped miniature solid-state laser sources. Final report, 1 May 1986-30 April 1989.** Gerstenberger, D.C.; Wallace, R.W. Lightwave Electronics Corp., Mountain View, CA (USA). Jun 1989. 37p. Available from NTIS, PC A03/MF A01.

This research program has dealt with the development of efficient and compact sources of visible laser light based on the nonlinear optical conversion of the outputs of diode pumped solid state lasers. Intracavity frequency doubling, frequency doubling of continuous wave single frequency nonplanar ring Nd:YAG lasers in external resonant cavities and single pass doubling of diode pumped Q-switched lasers were studied. Nonlinear materials including lithium diffused lithium niobate, magnesium oxide doped lithium niobate and potassium titanyl phosphate were examined. We obtained 45 mW of cw green light from an monolithic externally resonant cavity constructed of MgO:$LiNbO_3$ pumped by a 200 mW single-frequency Nd:YAG laser. This doubler was electro-optically locked into resonance with the laser oscillator and maintained at phasematching temperature by a miniature platinum hybrid heater-sensor element and control circuit. Peak power $LiNbO_3$ over 200 mW in the green were measured with this doubling device when pumped by a single frequency pulsed 500 mW source.

3145 (AD-A–210758/9/XAB) **Semiconductor quantum-well lasers and related optoelectronic devices on silicon, III-V. Technical report.** Holonyak, N.; Hsieh, K.C.; Stillman, G.E. Illinois Univ., Urbana, IL (USA). Dept. of Electrical and Computer Engineering. Jun 1989. 35p. (TR–1). Available from NTIS, PC A03/MF A01.

Although an ultimate goal of this work is to achieve long term reliable laser operation of Al(x)Ga(1-x)As-GaAs quantum-well heterostructures (QWH's), or similar III-V QWH's, grown on Si, this has proven to be a formidable enough problem that to the best of our knowledge no one has exceeded the results we reported in 1987 and 1988. This problem is of such dimensions that it may not be solved for as much as 10 years, or even more. All we know so far is that continuous (cw) 300 K Al(x)Ga(1-x)As-GaAs QWH lasers can be grown on Si, and that, indeed, the heat sinking of an Al(x)Ga(1-x)As-GaAs QWH laser on Si is better than a similar laser on a GaAs substrate. Nevertheless, the problem of growing better versions of these devices (i.e., long-lived high-performance cw 300 K lasers on Si) has run into the fundamental issue of the large GaAs-Si lattice and thermal expansion mismatch, and hence the built-in difficulty in reducing the defects guaranteed by mismatch. The authors worked further on the problem of Al(x)Ga(1-x)As-GaAs QWH lasers on Si, other QWH laser problems, as well as an impurity-induced layer disordering (or layer intermixing, IILD) and its application in laser devices this work is briefly described.

3146 (AD-A–210769/6/XAB) **Dissociation and vibrational relaxation of XeF by various collision partners.** Bott, J.F.; Heidner, R.F.; Holloway, J.S.; Koffend, J.B.; Kwok, M.A. Aerospace Corp., El Segundo, CA (USA). Laboratory Operations. 15 Jul 1989. 26p. (TR–0088(3930-04)-2). Available from NTIS, PC A03/MF A01.

The removal rates of the lower levels of XeF strongly affect the overall efficiency of the XeF excimer laser operating on the B yields X transitions. The authors have deduced the removal rates of XeF(X,v = 3) in krypton, xenon, nitrogen, and carbon dioxide and the removal rates of XeF(X,v = 0) in sulfur hexafluoride by monitoring the populations of vibrational levels formed by the photolysis XeF_2. The time history of the selected vibrational population is monitored with a continuous-wave (cw) tunable dye laser tuned to an absorption feature of the selected vibrational/rotational level. The studies show a rapid vibrational relaxation followed by a common decay rate of the coupled vibrational levels. The rare gases were found to remove XeF (X) with rate coefficients that differed from one another by less than a factor of 1.6. Larger removal-rate coefficients were measured for molecular-collision partners, with XeF_2 having the largest rate coefficient. Rate coefficients were also determined for the concerted vibrational relaxation of v = 3 although the values do not represent state-to-state rate coefficients. Fast vibrational relaxation is required to empty the lower levels of the laser transitions so the vibrational bottlenecking does not terminate laser action prematurely.

3147 (AD-A–210778/7/XAB) **Noise levels in a tunable CO_2 laser source.** Kachelmyer, A.L.; Eng, R.S. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. Dec 1988. 17p. (MS–8060). Available from NTIS, PC A03/MF A01.

Pub. in Proceedings of the International Conference on Lasers '88, 322-338 (4-9 Dec 1988).

This reprint considers the measurement of amplitude modulation (AM) and phase modulation (PM) noise in a tunable CO_2 laser source. Theoretical and experimental heterodyned output spectrums compare the tunable source to a clean reference laser.

3148 (AD-A–210780/3/XAB) **Binary micro optics: An application to beam steering.** Goltsos, W.; Holz, M. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 1989. 12p. (MS–8285). Available from NTIS, PC A03/MF A01.

Pub. in SPIE Volume 1052 - Holographic Optics: Optically and Computer Generated, 131-141(1989).

Agile steering of a helium-neon laser beam (lambda = 632.8nm) was demonstrated using a complementary pair of 5-cm-aperture diffractive microlens arrays in the Galilean telescopic geometry. Having as many as 60,000 F/5 microlenses, each with parabolic phase profile and 200 micrometers diameter, results in nearly aberration-free beam steering over 11 deg. field of view for top + or - 100 micrometers lateral displacements of one array relative to the other. Wavefront quality and steering efficiency of the deflected beam has been measured as a function of steering angle and is compared to a simple theoretical model.

3149 (AD-A–210844/7/XAB) **Coupled multiline c-w (continuous-wave) HF (hydrogen fluoride) lasers: Experimental performance. Technical report.** Bernard, J.M.; Chodzko, R.A.; Mirels, H. Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab. 1 Jul 1989. 26p. (TR–0086A(2060)-2). Available from NTIS, PC A03/MF A01.

The experimental performance of two coupled arc-driven continuous-wave HF chemical lasers employing unstable resonators has been measured. Mode-matched adjoint coupling of 20% was accomplished with a beam splitter. Multiline interference fringes were obtained when the two laser output beams were overlapped in the near field. The mutual coherence of the two beams was inferred from measurement of the visibility of these fringes. Single-line fringe visibility was measured as 98% +/- 2% for each of the two strongest lines. These data suggest that the two outputs are nearly completely phase-locked. This locking was found to be insensitive to perturbations in the lengths of the laser resonators. Mode-beating measurements also suggest complete phase locking, as the coupled system behaves like a single laser cavity. The coherent combination of the two laser output beams was attempted by minimizing the optical path difference between these beams, at an external measuring station. This was achieved by changing the external path length of one beam until maximum multiline visibility (97%) was obtained. Demonstration of the corresponding far-field peak intensity enhancement and reduction in spot size for the combined outputs was also accomplished.

3150 (AD-A–210861/1/XAB) **Electroabsorption in single quantum-well GaAs laser structures.** DeTemple, T.A. Illinois Univ., Urbana, IL (USA). 1 May 1989. 4p. Available from NTIS, PC A02/MF A01.

Pub. in Applied Physics Letters, Vol. 54, No. 18, 1716-1718(1 May 1989).

The electric-field-dependent spectral properties of a GaAs graded-barrier quantum-well heterostructure laser are measured for the first time. Data presented show that the electroabsorption below the band gap is due to states in the confinement layers perturbed by the quantum well under high field conditions. This effect, which is intermediary between the quantum confined Stark effect and bulk Franz Keldysh effect, should be present in all quantum well system with shallow wells in short, high field-depletion regions.

3151 (AD-A–210879/3/XAB) **Non-reciprocity of autoionizing interferences: Lasers without inversion.** Harris, S.E. Stanford Univ., CA (USA). Edward L. Ginzton Lab. 29 Sep 1988. 6p. Available from NTIS, PC A02/MF A01.

Pub. in OSA Proceedings on Short Wavelength Coherent Radiation: Generation and Applications, Vol. 2, 414-417(26-29 Sep 1988).

Interferences of autoionizing lines may reduce or eliminate absorption of lower level atoms. Stimulated emission shows no such interferences, thereby allowing laser gain without population inversion.

3152 (AD-A–210947/8/XAB) **Lasers without inversion: Interference of lifetime-broadened resonances.** Harris, S.E. Stanford Univ., CA (USA). Edward L. Ginzton Lab. 27 Feb 1989. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Physics Review Letters, Vol. 62, No. 9, 1033-1036(27 Feb 1989).

If two upper levels of a four-level laser system are purely lifetime broadened, and decay to an identical continuum, there will be an interference in the absorption profile of lower-level atoms; this interference is absent from the stimulated-emission profile of the upper-level atoms. Laser amplification may then be obtained without inversion. Examples include interfering autoionizing levels, and tunneling systems.

3153 (AD-A–211039/3/XAB) **Modulation mixing in a multimode dye laser.** Koch, K.; Chakmakjian, S.H.; Papademetriou, S.; Stroud, C.R. Rochester Univ., NY (USA). Inst. of Optics. 1 Jun 1989. 8p. Available from NTIS, PC A02/MF A01.

Pub. in Physical Review A, Vol. 39, No. 11, 5744-5750(1 Jun 1989).

An argon-ion laser, modulated at two or more frequencies is used to pump a multimode dye laser. Time series of the modulated pump and the output of the dye laser are collected simultaneously. The dye-laser response is analyzed for the presence of chaotic and quasi-periodic attractors. One can estimate and compare the correlation dimension and the order-2 Renyi entropy of both the modulated-pump and dye-laser output signals using an embedding-space technique. Fourier transforms of the time series are also compared.

3154 (AD-A–211117/7/XAB) **Laser physics and laser techniques. Final report.** Siegman, A.E. Stanford Univ., CA (USA). Edward L. Ginzton Lab. Jun 1989. 259p. Available from NTIS, PC A12/MF A01.

Several areas of Laser Physics and Laser Techniques are reported on, including ultrafast physical measurements; the development of a new subpicosecond time-response photodetector; identification and analysis of an important new quantum-noise limit for unstable laser oscillators; and useful advances in stable and unstable laser resonator theory.

3155 (LA–11567-MS) **Mixing of gases in large volumes by forced injection.** Greiner, N.R.; Heaton, R.C.; Hemberger, P.H.; Cisper, M.E.; Sandoval, W.F.; Alarid, J.E. Los Alamos National Lab., NM (USA). Oct 1989. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90001811. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes a set of experiments that demonstrate a gas mixing procedure suitable for use with large chemical lasers having cylindrical geometry. Mixing is accomplished by forceful injection of one of the reactive gas components into a reaction chamber containing all the other components of the desired final mixture. Experimental data are presented for mixing chambers 0.25 m and 1 m in diameter, although the procedure should be usable for even larger volumes. Schlieren images obtained in the smaller of the two volumes provide a good visualization of the mixing process and show that the injection concept is valid. These data also show that the optical quality of the gas mixing recovers within a few tenths of a second after the injection is complete. Mass spectrometric measurements taken at various points in the larger of the two volumes reveal oscillations in the injected gas concentration for about 60 s after injection. The turbulent mixing process is probably complete at that time. However, there is evidence of possible concentration gradients of a few percent across the vessel under some injection conditions. These apparent gradients persist for many minutes and are probably stabilized by buoyancy effects. The gas injection causes a temperature excursion in the vessel of typically 6 K. This decays to 3 degrees in approximately 40 s. The temperature excursion does not appear to depend on the amount of injected gas for the cases studied. 2 refs., 10 figs., 1 tab.

3156 (LA-UR–89-3394) **Lasing on the third harmonic.** Warren, R.W.; Haynes, L.C.; Feldman, D.W.; Stein, W.E.; Gitomer, S.J. Los Alamos National Lab., NM (USA). [1989]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8908134–12: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90002389. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Los Alamos Free-Electron Laser has recently lased near 4 μm on the third harmonic of the fundamental frequency of about 12 μm. By choice of intercavity apertures and cavity length, lasing can be forced to occur on both frequencies simultaneously or on either one alone. 8 refs., 3 figs., 1 tab.

3157 (LA-UR–89-3395) **High-field pulsed microwigglers.** Warren, R.W.; Feldman, D.W.; Preston, D. Los Alamos National Lab., NM (USA). [1989]. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8908134–11: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90002388. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Conventional wigglers made with periods of less than a few centimeters generate light of short wavelength, but usually have low gain because of their low fields. Iron-free electromagnets driven by high pulsed currents can generate the high fields needed. We will discuss the design and construction of such magnets. 4 refs., 7 figs.

3158 (LA-UR–89-3406) **Compact rf-linac free-electron lasers.** Goldstein, J.C.; Sheffield, R.L.; Carlsten, B.E.; Warren, R.W. Los Alamos National Lab., NM (USA). 1989. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8908134–9: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90002386. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Design studies using the INEX simulation methods are presented for an infrared compact rf-linac-driven FEL. The possibility of such a device relies upon two technological advances: a very bright electron beam from a linac with a photocathode injector, and a short-period, high-field wiggler. 10 refs., 6 figs., 3 tabs.

3159 (LA-UR–89-3438) **Optical design and performance of an XUV FEL [free-electron laser] oscillator.** Goldstein, J.C.; McVey, B.D.; Newnam, B.E. Los Alamos National Lab., NM (USA). [1989]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8908134–8: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90002381. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A study of numerical simulation of the performance of a multifacet metal mirror ring resonator FEL is presented for several XUV wavelengths. Laser performance in the presence of mirror aberrations and thermal distortion is calculated for two different output coupling methods, a scraper mirror and a hole. 11 refs., 1 fig.

3160 (LA-UR–89-3581) **Theory of harmonic radiation using a single-electron source model.** Schmitt, M.J.; Elliott, C.J. Los Alamos National Lab., NM (USA). [1989]. 20p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8908134–16: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90002412. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Significant progress has recently been made toward the understanding of the various mechanisms that generate harmonic radiation in plane-polarized free electron lasers. Within the context of a single-frequency coherent-spontaneous emission model, a distributed transverse source function for a single electron has been derived. This source is multiply peaked, with the number of peaks being equal to the harmonic number. The peaks and nulls in the radiation source are analogous to the radiation peaks seen in the spontaneous radiation pattern of a single electron. When the distributed source function is averaged over transverse space, the simplified one-dimensional results are recovered. The distributed source function model predicts the generation of even harmonic radiation with odd-symmetry in the electron wiggle plane (for electrons traveling along the wiggler axis) and odd harmonic radiation patterns with even transverse symmetry. A method for modeling the multi-pole nature of the harmonic radiation on a discrete grid is described. When the transverse electron beam distribution is slowly varying, all the harmonics can be adequately modeled with multipoles having only a few peaks. This model has been incorporated into the 3-D FEL simulation code FELEX. Simulations of the Los Alamos and Stanford FEL oscillators have been performed. How the harmonic transverse spatial electric field profiles change for different operating conditions is examined. 11 refs., 5 figs.

3161 (N–89-27871 vp) **Operational parameters for the superconducting cavity maser.** Wang, R.T.; Dick, G.J.; Strayer, D.M. Jet Propulsion Lab., Pasadena, CA (USA). May 1989. (NASA-CR–185431;JPL-TDA-PR–42-97;NAS–1.26:185431). In *The Telecommunications and Data Acquisition Report.* Available from NTIS, PC A17/MF A01.

Tests of the superconducting cavity maser (SCM) ultra-stable frequency source have been made for the first time using a hydrogen maser for a frequency reference. In addition to characterizing the frequency stability, the sensitivity of the output frequency to several crucial parameters was determined for various operating conditions. Based on this determination, the refrigeration and thermal control systems of the SCM were modified. Subsequent tests showed substantially improved performance, especially at the longest averaging times.

3162 (N–89-27871 vp) **Operating and environmental characteristics of Sigma Tau hydrogen masers used in the Very Long Baseline Array (VLBA).** Tucker, T.K. Jet Propulsion Lab., Pasadena, CA (USA). May 1989. (NASA-CR–185431;JPL-TDA-PR–42-97;NAS–1.26:185431). In *The Telecommunications and Data Acquisition Report.* Available from NTIS, PC A17/MF A01.

Presented here are the results obtained from performance evaluation of a pair of Sigma Tau Standards Corporation Model VLBA-112 active hydrogen maser frequency standards. These masers were manufactured for the National Radio Astronomy Observatory (NRAO) for use on the Very Long Baseline Array (VLBA) project and were furnished to the Jet Propulsion Laboratory (JPL) for the purpose of these tests. Tests on the two masers were performed in the JPL Frequency Standards Laboratory (FSL) and included the characterization of output frequency stability versus environmental factors such as temperature, humidity, magnetic field, and barometric pressure. The performance tests also included the determination of phase noise and Allan variance using both FSL and Sigma Tau masers as references. All tests were conducted under controlled laboratory conditions, with only the desired environmental and operational parameters varied to determine sensitivity to external environment.

3163 (N–89-27871 vp) **A novel approach to a PPM-modulated frequency-doubled electro-optic cavity-dumped**

Nd:YAG laser. Robinson, D.L. Jet Propulsion Lab., Pasadena, CA (USA). May 1989. (NASA-CR–185431;JPL-TDA-PR–42-97;NAS–1.26:185431). In *The Telecommunications and Data Acquisition Report.* Available from NTIS, PC A17/MF A01.

A technique which can provide frequency doubling, with high efficiency, while cavity dumping a laser for pulse position M-ary modulation while being used for an optical communication link is discussed. This approach uses a secondary cavity that provides feedback of the undoubled fundamental light, which is normally lost, into the primary cavity to be recirculated and frequency doubled. Specific operations of the electrooptic modulator and frequency-doubling crystal are described along with the overall modulation scheme and experimental setup.

3164 (N–89-28118, pp. 249-252) **Diode-pumped laser research.** Ramos-Izquierdo, L.; Bufton, J.L.; Chan, K. National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center. 1988. (NASA-TM–101257;NAS–1.15:101257). In *Laboratory for Oceans.* Available from NTIS, PC A12/MF A01.

The Laboratory for Oceans is currently working on the development of compact laser diode array (LD) pumped Nd:YAG lasers for use in space-based altimetry and ranging. Laser diode-array pumping technology promises to increase the electrical to optical efficiency of solid state lasers by an order of magnitude with a lifetime increase of nearly three orders of magnitude relative to today's conventional flashlamp-pumped laser systems. The small size, efficiency, and ruggedness make LD-pumped solid state lasers ideal for space based applications. In an in-house RTOP effort, a novel multiple-pass LD-pumped Nd:YAG laser amplifier was designed and tested to increase the 100 microjoule output pulse energy of the Lightwave laser oscillator. Preliminary results have yielded a round trip amplifier gain of about 15 percent using 7 microjoule LD-pump energy. As a parallel activity, funding was recently obtained to investigate the possible use of custom made fiber optic arrays to obtain an efficient optical coupling mechanism between the emitting laser diode-arrays and the target solid state laser material. Fiber optic coupling arrays would allow for the easy manipulation of the spatial emitting pattern of the diode pump sources to match either an end or side pumping laser configuration.

3165 (PB–89-870935/XAB) **Excimer lasers: Applied research and commercial development. January 1980-September 1989 (Citations from the Searchable Physics Information Notices data base). Report for January 1980-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 123p. Available from NTISPC N01/MF N01.

Supersedes PB–88-869367.

This bibliography contains citations concerning research, development, testing, stability, and reliability of both XeCl and XeF excimer lasers. Excimer laser utilization for vapor-deposited coating processes, cardiovascular surgery, and microelectronics fabrication are presented. Laser etching of polymers, diamonds, and hard carbon films are discussed. Construction of very large excimer-laser amplifiers and comparative analysis of wide-band excimer lasers with optical or electron-beam-pumping are examined. (This updated bibliography contains 293 citations, 68 of which are new entries to the previous edition.)

3166 (UCRL–21254) **Theory for high gain, high power free electron lasers: Final report.** Colson, W.B. Lawrence Livermore National Lab., CA (USA); Berkeley Research Associates, Inc., CA (USA). 1989. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (BRA–89-342R). Order Number DE90003024. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the past contracting period, the research on high gain, high power free electron lasers (FELs) has been fruitful. The findings have resulted in publications, presentations, and some important new research topics in progress. The work has been accomplished in close collaboration with the FEL physicists at LLNL including weekly visits to the LLNL Beam Research Building. The new research proposed is also coordinated closely with specific LLNL FEL project physicists, and the upcoming high-gain, high-power amplifier experiments during the next year on the Paladin FEL. The research includes analysis of the initial ELF experiments, identification of new FEL physics in Paladin at 5m length, electron beam distributions from future induction linacs, electron beam distributions in weak optical fields, a major FEL review paper, a simple understanding of FEL optical guiding, multimode analysis applied to single-pass FEL amplifiers, a LLNL review talk on FEL sidebands and electron distribution functions. 3 refs.

3167 (UCRL–100891) **Prospects for a soft x-ray FEL powered by a relativistic-klystron high-gradient accelerator (RK-HGA).** Shay, H.D.; Barletta, W.A.; Yu, S.S.; Schlueter, R.; Deis, G.A. Lawrence Livermore National Lab., CA (USA). 28 Sep 1989. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-8908134–15: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90002822. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We present here the concept of x-ray FELs using high gain, single-pass amplifiers with electron beams accelerated in high gradient structures powered by relativistic klystrons. Other authors have also considered x-ray FELs; the unique aspect of this paper is the use of high gradient acceleration. One of the authors has previously presented preliminary studies on this concept. The intent in this paper is to display the results of a top level design study on a high gain FEL, to present its sensitivity to a variety of fabrication and tuning errors, to discuss several mechanisms for increasing gain yet more, and to present explicitly the output characteristics of such an FEL. The philosophy of the design study is to find a plausible operating point which employs existing or nearly existing state-of-the-art technologies while minimizing the accelerator and wiggler lengths. The notion is to distribute the technical risk as evenly as possible over the several technologies so that each must advance only slightly in order to make this design feasible. This study entailed no systematic investigation of possible costs so that, for example, the sole criterion for balancing the trade-off between beam energy and wiggler length is that the two components have comparable lengths. 20 refs., 10 figs., 1 tab.

3168 (UCRL–102044) **Laser glass (1989).** Weber, M.J. Lawrence Livermore National Lab., CA (USA). Oct 1989. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8911121–1: 2. international symposium on new glass, Tokyo (Japan), 29-30 Nov 1989). Order Number DE90002754. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Glasses play many and varied roles in laser systems, both passive and active. Properties of special interest include the transparency for transmitting optical components, absorption and emission spectra and excited state lifetimes of paramagnetic ions for amplifying media, magnetooptic properties for optical isolators, acoustooptic properties for optical modulators, and nonlinear optical properties for controlling beam propagation and for photonic switching. In this paper we review briefly the role and extent to which glasses have been used for lasing. Although the exploitation of glass for lasers is a mature activity, it is not exhausted. The number of glass lasers actually demonstrated is much smaller, and the number of commercial laser glasses is smaller still. 22 refs., 1 fig., 2 tabs.

3169 Effect of mode competition on the efficiency of FEL oscillators in the low gain regime. Levush, B. (Univ. of Maryland (US)); Antonsen, T.M.; Serbeto, A. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2P38.

In this paper the efficiency of energy extraction from the electron beam in low gain FEL oscillators is investigated. Using a normalized beam in low gain FEL oscillators is investigated. Using a normalized set of nonlinear equations the optimum values of the efficiency is presented. The efficiency obtained by utilizing the multimode model is compared with the results from the single mode model.

3170 Ultrahigh brightness XeCl laser system. Tallman, C.R. (Lawrence Livermore National Lab., CA (USA)); Taylor, A.J.; Roberts, J.P.; Lester, C.S.; Gosnell, T.R.; Long, W.H. pp. 443 of

OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper TUJ46.

High brightness excimer laser systems are being used to explore the interaction of intense coherent UV radiation with matter. Applications of current systems include the generation of picosecond x-ray pulses, investigations of possible x-ray laser pumping schemes, studies of multiphoton phenomena in atomic species, and time-resolved photchemistry. Systems based on the amplification of subpicosecond pulses in small aperture (– 1-cm^2) XeCl or KrF amplifiers routinely deliver focal spot intensities in excess of 10^{17} W/Cm^2. Scaling to higher intensities requires an additional large aperture amplifier which preserves near diffraction limited beam quality and subpicosecond pulse duration. The authors describe here a large aperture 1-Hz XeCl system designed to deliver 0.5-J subpiosecond pulses and yield intensities on target in excess of 10^{19} W/cm^2.

3171 Design and operation of high efficiency electron-beam-initiated chemical lasers. York, G.W. (Los Alamos National Lab., NM (USA)); Quigley, G.P.; Salesky, E.T. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper THA5.

This paper describes a new electron-beam initiated laser system developed at Los Alamos to explore a recently discovered operating regime of chemical lasers. This parameter space is attained by initiating a chemical reaction weakly and over a long time duration while maintaining a high internal optical flux within the laser cavity throughout the burn. By operating in this regime, relatively high specific energies can be produced at extremely high electrical efficiencies. The device developed to explore this parameter space is shown. A preliminary design is presented for a laboratory system.

3172 Thermal stress in the edge cladding of Nova glass laser disks. Pitts, J.H. (Lawrence Livermore National Lab., PO Box 5508, Livermore, CA 94550 (USA)); Kong, M.K.; Gerhard, M.A. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The authors calculated thermal stresses in Nova glass laser disks having light-absorbing edge cladding glass attached to the periphery with an epoxy adhesive. Closed-form solutions indicated that, because the epoxy adhesive is only 25 μm across, it does not significantly affect the thermal stress in the disk or cladding glass. Numerical results showed a peak tensile stress in the cladding glass of 24 MPa when the cladding glass had a uniform absorption coefficient of 7.5 cm^{-1}. This peak value is reduced to 19 MPa if surface parasitic oscillation heating is eliminated by tilting the disk edges. The peak tensile stresses exceed the typical 7 to 14-MPa working stress for glass; however, have not observed any disk or cladding glass failures at peak Nova fluences of 20 J/cm^2. They have observed delamination of the epoxy adhesive bond at fluences several times that which would occur on Nova. Replacement laser disks will incorporate cladding with a reduced absorption coefficient of 4.5 cm^{-1}. Recent experiments show that this reduced absorption coefficient is satisfactory.

3173 Dynamics of coupled electron-nucleon motion in a laser field. Hartmann, F.X. (Institute for Defense Analyses, Alexandria, Virginia (US)); Garcia, K.K.; Munro, J.K. Jr.; Noid, D.W. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 87-92 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

Energy transfer processes in single particle coupled nucleon-electron models interacting with an intense laser field are studied using semi-classical quantization of the coupled classical Hamiltonian.

3174 Absolute rate measurements of two-photon process of gases, liquids, and solids. Chen, C.H. (Chemical Physics Section, Oak Ridge, National Laboratory Oak Ridge, Tennessee 37831-6378 (US)); McCann, M.P.; Payne, M.G. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 130-132 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

Due to rapid improvements in high-power laser performance, two-photon absorption processes have become a very useful tool for studying the molecular structures of various gases, liquids and solids. However, measurements of absolute two-photon absorption cross sections were more or less ignored previously because of their small size. In this work, we obtained not only the two-photon absorption spectra, but also measurements of their absolute cross sections for various gases, liquids, and solids.

3175 Measurement of transition moments between molecular excited electronic states using the Autler-Townes effect. Lau, A.M.F. (Combustion Research Facility, Sandia National Laboratories, Livermore, CA 94550 (US)); Chandler, D.W.; Quesada, M.A.; Parker, D.H. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 133-135 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

This paper reports the observation of the Autler-Townes splitting in the two-color four-photon ionization of hydrogen molecules, and the good agreement of theory with experiment. From the theoretical fits to the spectral profiles, the value of the electric dipole transition moment between the excited vibronic states $E,F^1\Sigma^+_g$, v=6 and $D^1\Pi_u$, v'=2 is determined to be 2.0±0.5 a.u.

3176 The suppression of stimulated hyper-Raman emission in Na due to parametric four-wave mixing. Moore, M.A. (Chemical Physics Section, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6378 (US)); Garrett, W.R.; Payne, M.G. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 139-141 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

We show that an interference effect involving four-wave mixing can almost totally suppress predicted examples of stimulated hyper-Raman emission in the forward direction of a laser pump beam. The effect is demonstrated in Na vapor.

3177 Nonlinear absorption of CO_2 laser radiation in p-type InSb. James, R.B. (Sandia National Laboratories, Livermore, CA 94550 (US)); Chang, Y.C.; Smith, D.L. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 186-189 (1 Oct 1988). Sponsored by U.S. DOE Albuquerque Operations Office. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

Calculations of the intervalence-band absorption saturation in p-type InSb by high-intensity CO_2 laser light are reported. The intensity-dependent absorption coefficient is found to be well described by an inhomogeneously broadened two-level model, and values of the saturation intensity are presented.

3178 Excited state absorption of Sm^{2+} in SrF_2. Payne, S.A. (University of California, Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550 (US)); Chase, L.L.; Krupke, W.F. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 413-418 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

The excited state absorption spectrum of Sm^{2+} in SrF_2 has been observed. The absorption peaks associated with the $^5D_0(4f^6)$ excited state were found to be displaced by approximately 3000 cm^{-1} from the absorption bands arising from the $^7F_0(4f^6)$ ground state (after taking the $^5D_0$–$^7F_0$ energy separation into account). The

observed peak separation is ascribed to the 4f–5d exchange interaction. From the measured peak positions, the exchange energy for the Sm^{2+} impurity was determined to be about the same order of magnitude as expected for the free ion. The implications of the properties of the excited state absorption bands for the performance of the $SrF_2:Sm^{2+}$ laser are considered.

3179 **Liquid excimers: lasing Xe_2 and Kr_2 in liquid argon.** Loree, T.R. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Showalter, R.R.; Johnson, T.M.; Birmingham, B.S.; Hughes, W.M. *Optics Letters (USA)*, 14(19): 1051-1053 (1 Oct 1989).

By pumping a small cryogenic cell with a 40-nsec, 1-MeV *e*-beam pulse, we have excited lasing in dilute mixtures of xenon or krypton in liquid argon. The lasing occurred at 175 nm for the excimer Xe_2 and at 147 nm for Kr_2.

3180 **Low-frequency self-pulsations in asymmetric external-cavity semiconductor lasers due to multiple-feedback effects.** Park, J. (Optoelectronic Device Physics Group, Center for High Technology Materials, University of New Mexico, Albuquerque, New Mexico 87131 (US)); Seo, D.; McInerney, J.G.; Dente, G.C.; Osinski, M. *Optics Letters (USA)*, 14(19): 1054-1056 (1 Oct 1989).

We investigate the dynamical stability of external-cavity semiconductor lasers with deliberate tilt asymmetries. Experimentally observed low-frequency self-pulsations are explained by small-signal analysis based on a new rate-equation model that uses a time-dependent effective reflectivity to include multiple-feedback effects. We observe and explain the dependence of the self-pulsation frequency on the strength and degree of asymmetry of the feedback, on the injection current, and on the external-cavity length. These results are important in interpreting instabilities, chaos, and other complex dynamical phenomena in external-cavity semiconductor lasers.

3181 **Waveguide mode deformation in free-electron lasers.** Fajans, J. (Department of Physics, University of California, Berkeley, Berkeley, California 94720 (US)); Wurtele, J.S. *Physics of Fluids B: Plasma Physics (USA)*, 1(10): 2073-2084 (Oct 1989).

The free-electron laser (FEL)-induced modifications to the vacuum waveguide modes are calculated for low-frequency FEL's. Typically, the mode modifications are large and exhibit complicated axial behaviors. In addition to the wave component with a near vacuum wavenumber, components at two upshifted wavenumbers must be analyzed. Electron beam surface charges and currents are also important. At low gain, effects from all three roots of the FEL dispersion relation must be included. The dominant modification is due to the electron beam space-charge wave.

3182 **Linear analysis of a free-electron laser coupled to betatron oscillations.** Latham, P.E. (Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742 (US)). *Physics of Fluids B: Plasma Physics (USA)*, 1(10): 2085-2098 (Oct 1989).

The dispersion relation is derived for the interaction of a sheet beam propagating between parallel plates in a planar wiggler magnetic field. Instead of the usual free electron laser (FEL) mode, one is considered in which the radiation field is perpendicular to the quiver velocity and couples either to betatron or plasma oscillations. In the cold beam limit, coupling to betatron oscillations leads to an absolute instability. This mode competes with the conventional FEL and can disrupt the beam unless suppressed. The effects of energy spread are investigated, and a critical energy spread is found that suppresses the instability. For ultrarelativistic beams, this energy spread is an exponentially decreasing function of the beam energy. For moderately relativistic high current beams, it is proportional to the square root of the beam current. In this regime, there is a limit to the current that can propagate stably in the FEL circuit. Coupling to plasma oscillations also leads to an instability. However, the instability associated with this mode can be made convective with a suitable choice of parameters, and thus is not particularly dangerous to the conventional FEL. It is, however, interesting because the dispersion relation is characteristic of a second harmonic FEL, even though the wiggler is planar.

3183 **Transition from quantum-noise-driven dynamics to deterministic dynamics in a multimode laser.** Beck, M. (The Institute of Optics, University of Rochester, Rochester, New York 14627 (US)); McMackin, I.; Raymer, M.G. *Physical Review [Section] A: General Physics (USA)*, 40(5): 2410-2416 (1 Sep 1989).

The fluctuation behavior of the mode amplitudes in a multimode dye laser near threshold is investigated numerically. The laser is modeled by semiclassical, third-order laser theory that includes a stochastic Langevin force to simulate quantum noise. We find two different limiting types of behavior. Just above the lasing threshold the mode fluctuations are found to be dominated by quantum noise, while above a certain pump power the fluctuations are found to be essentially deterministic. The effect of pump fluctuations is also simulated. We find that a multimode laser acts as a low-pass filter on the pump fluctuations, as is found for a single-mode laser.

3184 **Improved laser-beam uniformity using the angular dispersion of frequency-modulated light.** Skupsky, S. (Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 14623-1299 (US)); Short, R.W.; Kessler, T.; Craxton, R.S.; Letzring, S.; Soures, J.M. *Journal of Applied Physics (USA)*, 66(8): 3456-3462 (15 Oct 1989).

A new technique is presented for obtaining highly smooth focused laser beams. This approach is consistent with the constraints on frequency tripling the light, and it will not produce any significant high-intensity spikes within the laser chain, making the technique attractive for the high-power glass lasers used in current fusion experiments. Smoothing is obtained by imposing a frequency-modulated bandwidth on the laser beam using an electro-optic crystal. A pair of gratings is used to disperse the frequencies across the beam, without distorting the temporal pulse shape. The beam is broken up into beamlets, using a phase plate, such that the beamlet diffraction-limited focal spot is the size of the target. The time-averaged interference between beamlets is greatly reduced because of the frequency differences between the beamlets, and the result is a relatively smooth diffraction-limited intensity pattern on target.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 2134, 2259, 2473, 2516, 2530, 2661, 3937

3185 (AD-A–211107/8/XAB) **Survey of measurements and measuring techniques in rapidly distorted compressible turbulent boundary layers.** Fernholz, H.H.; Dussauge, J.P.; Finlay, P.J.; Smits, A.J.; Reshotko, E. Advisory Group for Aerospace Research and Development (AGARD), 92 - Neuilly-sur-Seine (France). May 1989. 132p. (AGARD-AG–315). Available from NTIS, PC A07/MF A01.

A large body of data for incompressible turbulent boundary layers was accumulated over many years by many investigations. The measurements revealed elements of the structure of this complex flow. Three-dimensional multiple-scale phenomena were observed, and there is the beginning of an understanding of the details of the structure and physics. This will lead to more-realistic models and physical understanding, which will be primary inputs into concepts of control of these turbulent boundary layers and will provide a framework to validate computations. At high speed, where compressibility is important, there is a paucity of data. The measurements are difficult to obtain and are not easily analyzed. At the same time, there appear to be some possibilities for simplification inherent in rapid distortion theory where the turbulent structure may be frozen if the disturbance is of short duration. There is a critical need for data to evaluate this concept, to provide a base for models of turbulence in compressible flows to compare with imcompressible flows, to provide a more-substantial base for our physical understanding, and to provide a framework for the evaluation of the extensive computations currently underway. Contents: Rapidly Distorted Compressible Boundary-Layers; Large Scale Motions in Supersonic Turbulent Boundary Layers; Skin-Friction Measurements by Laser Interferometry; Hot-Wire Anemometry in Supersonic Flow; Laser Doppler Anemometry; Laser Doppler Anemometry in Supersonic Flows:Problems of Seeding and Angular Bias; and Fluctuating Wall-Pressure Measurements.

3186 (AEEW-R–2201) **Calculated performance of a "hot-patch" for steady state post dryout experiments.** Hood, M.L. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Dec 1987. 20p. Order Number DE90608605. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the emergency cooling of water-cooled nuclear reactors, for example, there is a need for data on the heat transfer from hot dry surfaces to a coolant having a low thermodynamic quality. Such data are difficult to obtain because the surface tends to rewet, in a transient fashion, from the ends of the experimental test-section. In an attempt to prevent this rewetting, hot patches have been attached to the ends of the test-section. These are heated blocks of high thermal conductivity, capable of providing a local heat flux high enough to dry out the encroaching rewetting front. This paper presents the results of calculations on the performance of such a hot patch. The heat transfer near the dryout point is represented by an idealised boiling curve and steady state solutions are obtained for the temperature distribution within the hot patch and the surface heat flux. The stable position of the dryout point is calculated to be upstream of the hot patch at low pressure. As the pressure is increased the dryout point moves towards the hot patch. At a sufficiently high pressure it moves into and through the hot patch, so that a steady state cannot be sustained. The effects on the hot patch performance of internal cracks and of changes in design geometry are also presented. (author).

3187 (CONF-8906112–2) **Interfacial area in two-phase flow.** Ishii, M; Tan, M.J. Argonne National Lab., IL (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. symposium on energy engineering sciences; Argonne, IL (USA); 19-21 Jun 1989. Order Number DE90002210. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Knowledge of interfacial area is required for analysis and prediction of transient and steady characteristics of two-phase flow systems using the two-fluid models. Based on a survey of published work on the subject of interfacial area, it is recognized that there is virtually no data base for local interfacial area. This paper describes the ongoing development of interfacial area models and experimental techniques for measurement of local interfacial area concentration in gas-liquid and liquid-liquid two-phase systems. Mathematical relations between local interfacial area concentration and measurable quantities are derived based on kinematics and geometry. Two methods for determining local interfacial area are identified; both entail detection of passage of interfaces through fixed locations in the flow field. A multiple-sensor electrical-resistivity-probe technique is being developed for determination of local interfacial area in vertical gas-liquid bubbly flows. The technique consists of simultaneous measurements at two or four locations in the two-phase flow field of the local electrical resistivity of the two-phase mixture. Methods for data analysis are described. Limitations of the technique are briefly discussed. 16 refs.

3188 (FRNC-TH–3474) **Jet instabilities in liquid-liquid systems. Application to direct contact heat exchangers.** Tadrist, L. Aix-Marseille-1 Univ., 13 - Marseille (France). 1987. 307p. (In French). Order Number DE90721102. Available from NTIS (US Sales Only), PC A14/MF A01.

The behavior of a fluid injected in an immiscible fluid is studied. Results concerning the mean diameter of the drops resulting from a jet rupture, are directly correlated with the vortex dimensions, just before the breaking of the jet. Water, for the immiscible phase, and dodecane, for the miscible phase, are applied as fluid models. The drop by drop, laminar and turbulent flow models are discussed. The jet evolution from the injector up to the drops formation is studied under different flow models, taking into account different jet injection velocities. The study of the resolution for a cylindrical column resolution, comparison to the planar interface case, the axisymmetric and non-axisymmetric perturbation cases are given. The experimental device, the measurement principles and methods are explained, and the liquid-liquid system is analyzed.

3189 (INIS-BR–1686) **Thermohydraulic analysis of smooth and finned annular ducts.** Braga, C.V.M. Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Engenharia Mecanica. 1987. 339p. (In Portuguese). Order Number DE90608607. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The present work is concerned with the turbulent heat transfer and pressure drop in smooth and finned annular ducts overage heat transfer coefficients have been obtained by means of the heat exchanger theory. In addition, friction factors have also been determined. The experiments were performed by utilizing four double-pipe heat exchangers. The flowing fluids, in the heat exchangers, were air and water. The average heat transfer coefficients, for air flowing in the annular section, were determined by measuring the overall heat transfer coefficients of the heat exchangers. In order to attain fully developed conditions, the heat exchangers had a starting length of 30 hydraulic diameters. The thermal boundary conditions consisted of uniform temperature on the inner surface, the outer surface being insulated. The heat transfer coefficients and friction factors are presented in dimensionaless forms, as functions of the Reynolds number of the flow. The results for the smooth and finned annular ducts were compared. The purpose of such comparison was to study the influence of the fins on the pressure drop and heat transfer rate. In the case of the finned nular ducts, it is shown that the fin efficiency has some fluence on the heat transfer rates. The, a two-dimensional at transfer analysis was performed in order to obtain the n efficiency and the annular region efficiency. It is also shown that the overall thermal performance of finned surfaces epends mainly on the Nusselt number and on the region eficiency. These parameters are presented as functions of the Reynolds number of the flow and the geometry of the problem. (author).

3190 (INIS-BR–1691) **Falling-sphere radioactive viscometry.** Souza, R. de. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1987. 449p. (In Portuguese). Order Number DE90608608. Available from NTIS (US Sales Only), PC A19/MF A01 - OSTI; INIS.

In this work the falling sphere viscometric method was studies experimentally using a sphere tagged with ^{198}Au radiosotopo, the objective being the demosntration of the advantages of this technique in relation to the traditional method. The utilisation of the falling radioactive sphere permits the point-point monitoring of sphere position as a function of count rate. The fall tube wall and end effects were determined by this technique. Tests were performed with spheres of different diameters in four tubes. The application of this technique demosntrated the wall and end effects in sphere speed. The case of sphere fall in the steady slow regime allowed the determination of the terminal velocity, showing the increase of botton end effect as the sphere approaches the tube base. In the case the transient slow regime, the sphere was initially in a state of respose near the top surface. The data obtained show the influence of the free surface and wall on the sphere acceleration. These experimental data were applied to the Basset equation on order to verify the behaviour of the terms in this equation. (author).

3191 (LiU-Tek-Lic–1989-04) **Some heat transfer problems with phase change processes. Numerical and experimental analysis.** Linkoeping studies in science and technology. (no. 164). Moshfegh, B. Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering. 1989. 11p. Order Number DE90719414. Available from NTIS (US Sales Only), PC A03/MF A01.

Linkoeping studies in science and technology.; (no. 164).

The research emphasizes the numerical treatment of heat transfer characteristics of the models including phase change processes. Computational models were presented for the prediction of temperature. The finite element method, FEM, was used for the simulations. The predicted temperature for the food in a food container and the inner and outer surface temperatures of the triple-glazing window were also experimentally determined. The experimental results and the comparison with numerical simulations have shown that the proposed models provide a correct qualitative and quantitative representation of the heat transfer characteristics for the food container and the low-emissive triple-glazing window. Therefore this method can be used extensively for theoretical analysis and optimization of the heat transfer characteristics for models, including phase change processes under different, operational conditions and it is also indispensable for reducing the number of expensive time-consuming tests. (author).

3192 (LNCC–009/89) **Error analysis of some Galerkin - least squares methods for the elasticity equations.** Franca, L.P.; Stenberg, R. Laboratorio Nacional de Computacao Cientifica, Rio de

Janeiro, RJ (Brazil). May 1989. 28p. Order Number DE90608611. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We consider the recent technique of stabilizing mixed finite element methods by augmenting the Galerkin formulation with least squares terms calculated separately on each element. The error analysis is performed in a unified manner yielding improved results for some methods introduced earlier. In addition, a new formulation is introduced and analyzed.

3193 (LNCC–010/89) **Finite element approximations of the stokes flow problem based upon various variational principles.** Franca, L.P.; Hughers, T.J.R.; Stenberg, R. Laboratorio Nacional de Computacao Cientifica, Rio de Janeiro, RJ (Brazil). May 1989. 17p. Order Number DE90608612. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Finite element methods are constructed by adding to the usual Galerkin method terms that are mesh-dependent least-squares forms of the Euler-Lagrange equations. The methods are consistent and possess additional stability compared to the Galerkin method. Finite element interpolations, which are unstable in the Galerkin approach, are now convergent. The methodology is applied to the velocity-pressure formulation, a.k.a., Herrmann's formulation, to the stress-velocity formulation, a.k.a., Hellinger-Reissner's formulation and to a new formulation based on augmented stress, pressure and velocity.

3194 (LNCC–011/89) **Strong source heat transfer simulations based on a GalerKin/Gradient - least - squares method.** Franca, L.P.; Carmo, E.G.D. do. Laboratorio Nacional de Computacao Cientifica, Rio de Janeiro, RJ (Brazil). May 1989. 17p. Order Number DE90608613. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Heat conduction problems with temperature-dependent strong sources are modeled by an equation with a laplacian term, a linear term and a given source distribution term. When the linear-temperature-dependent source term is much larger than the laplacian term, we have a singular perturbation problem. In this case, boundary layers are formed to satisfy the Dirichlet boundary conditions. Although this is an elliptic equation, the standard Galerkin method solution is contaminated by spurious oscillations in the neighborhood of the boundary layers. Herein we employ a Galerkin/Gradient-least-squares method which eliminates all pathological phenomena of the Galerkin method. The method is constructed by adding to the Galerkin method a mesh-dependent term obtained by the least-squares form of the gradient of the Euler-Lagrange equation. Error estimates, numerical simulations in one-and multi-dimensions are given that attest the good stability and accuracy properties of the method.

3195 (N–89-17298, pp. 81-84) **Comparison of turbulence measurement methods.** Fralick, G.C. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

An experiment is described in which temperature (density) and velocity are measured separately but simultaneously as functions of time so that it is possible to determine the relationships among velocity, density, and the product of density and velocity. Temperatures were measured with a dual-wire thermocouple probe. Velocity data were supplied by a fringe laser-Doppler anemometer. Signals from thermocouples and the laser were recorded on FM magnetic tape for later processing.

3196 (N–89-17298, pp. 85-90) **Aerothermal modeling program. Phase 2, element A: improved numerical methods for turbulent viscous recirculating flows.** Karki, K.C. (Analytic and Computational Research, Inc., Los Angeles, CA (USA)); Mongia, H.C.; Patankar, S.V.; Runchal, A.K. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objective of this effort is to develop improved numerical schemes for predicting combustor flow fields. Various candidate numerical schemes were evaluated, and promising schemes were selected for detailed assessment. The criteria for evaluation included accuracy, computational efficiency, stability, and ease of extension to multidimensions. The candidate schemes were assessed against a variety of simple one- and two-dimensional problems. These results led to the selection of the following schemes for further evaluation: flux spline schemes (linear and cubic) and controlled numerical diffusion with internal feedback (CONDIF). The incorporation of the flux spline scheme and direct solution strategy in a computer program for three-dimensional flows is in progress.

3197 (N–89-17298, pp. 91-99) **Aerothermal modeling program. Phase 2, element B: Flow interaction experiment.** Nikjooy, M. (Purdue Univ., West Lafayette, IN (USA)); Mongia, H.C.; Murthy, S.N.B.; Sullivan, J.P. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

NASA has instituted an extensive effort to improve the design process and data base for the hot section components of gas turbine engines. The purpose of element B is to establish a benchmark quality data set that consists of measurements of the interaction of circular jets with swirling flow. Such flows are typical of those that occur in the primary zone of modern annular combustion liners. Extensive computations of the swirling flows are to be compared with the measurements for the purpose of assessing the accuracy of current physical models used to predict such flows.

3198 (N–89-17298, pp. 111-118) **Application of advanced diagnostics to airblast injector flows.** Mcvey, J.B.; Kennedy, J.B.; Russell, S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

This effort is concerned with the application of both conventional laser velocimetry and phase Doppler anemometry to the flow produced by an airblast nozzle. The emphasis is placed on the acquisition of data using actual engine injector/swirler components at (noncombusting) conditions simulating those encountered in the engine. The objective of the effort was to test the applicability of the instrumentation to real injector flows, to develop information on the behavior of injectors at high flow, and to provide data useful in the development of physical models of injector flows.

3199 (N–89-17298, pp. 169-179) **Measurement of airfoil heat transfer coefficients on a turbine stage.** Dring, R.P.; Blair, M.F.; Joslyn, H.D. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

A combined experimental and analytical program was conducted to examine the impact of a number of variables on the midspan heat transfer coefficients of the three airfoil rows in a one and one-half stage large scale turbine model. Variables included stator/rotor axial spacing, Reynolds number, turbine inlet turbulence, flow coefficient, relevant stator 1/stator 2 circumferential position, and rotation. Heat transfer data were acquired on the suction and pressure surfaces of the three airfoils. High density data were also acquired in the leading edge stagnation regions. Extensive documentation of the steady and unsteady aerodynamics was acquired. Finally, heat transfer data were compared with both a steady and an unsteady boundary layer analysis.

3200 (N–89-17298, pp. 199-209) **Two- and three-dimensional turbine blade row flow field simulations.** Buggeln, R.C.; Briley, W.R.; Mcdonald, H.; Shamroth, S.J.; Weinberg, B.C. National Aeronautics and Space Administration, Cleveland, OH

(USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

Work performed in the numerical simulation of turbine passage flows via a Navier-Stokes approach is discussed. Both laminar and turbulent simulations in both two and three dimensions are discussed. An outline of the approach, background, and an overview of the results are given.

3201 (N–89-17298, pp. 211-223) **Coolant passage heat transfer with rotation.** Hajek, T.J. (United Technologies Research Center, East Hartford, CT (USA)); Wagner, J.H.; Johnson, B.V. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objective is to develop a heat transfer and pressure drop data base, computational fluid dynamic techniques and heat transfer correlations for rotating multipass coolant passages, with and without flow tabulators. The experimental effort is focused on the simulation of configurations and conditions expected in the blades of advanced aircraft high pressure turbines. With the use of this data base, the effects of Coriolis and buoyancy forces on the coolant side flow can be included in the design of turbine blades.

3202 (N–89-17298, pp. 225-238) **Turbine airfoil film cooling.** Hylton, L.D.; Nirmalan, V.; Sultanian, B.K.; Kaufman, R.M. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The experimental data obtained in this program gives insight into the physical phenomena that occur on a film cooled airfoil, and should provide a relevant data base for verification of new design tools. Results indicate that the downstream film cooling process is a complex function of the thermal dilution and turbulence augmentation parameters with trends actually reversing as blowing strength and coolant-to-gas temperature ratio varied. The pressure surface of the airfoil is shown to exhibit a considerably higher degree of sensitivity to changes in the film cooling parameters and, consequently, should prove to be more of a challenge than the suction surface in accurately predicting heat transfer levels with downsteam film cooling.

3203 (N–89-24538) **Studying turbulence using numerical simulation databases, 2. Proceedings of the 1988 Summer Program.** Stanford Univ., CA (USA). Dec 1988. 291p. (NASA-CR–184905;NAS–1.26:184905;SU-CTR-S–88;CONF-8806435–: Summer program on studying turbulence using numerical simulation databases, Stanford, CA (USA), 27 Jun - 22 jul 1988). Available from NTIS, PC A13/MF A01.

Original contains color illustrations.

The focus of the program was on the use of direct numerical simulations of turbulent flow for study of turbulence physics and modeling. A special interest was placed on turbulent mixing layers. The required data for these investigations were generated from four newly developed codes for simulation of time and spatially developing incompressible and compressible mixing layers. Also of interest were the structure of wall bounded turbulent and transitional flows, evaluation of diagnostic techniques for detection of organized motions, energy transfer in isotropic turbulence, optical propagation through turbulent media, and detailed analysis of the interaction of vortical structures.

3204 (N–89-24538, pp. 29-39) **Phase decorrelation, streamwise vortices and acoustic radiation in mixing layers.** Ho, C. M.; Zohar, Y.; Moser, R. D.; Rogers, M. M.; Lele, S. K.; Buell, J. C. Stanford Univ., CA (USA). Dec 1988. (NASA-CR–184905;NAS–1.26:184905;SU-CTR-S–88;CONF-8806435–: Summer program on studying turbulence using numerical simulation databases, Stanford, CA (USA), 27 Jun - 22 jul 1988). In *Studying turbulence using numerical simulation databases, 2. Proceedings of the 1988 Summer Program.* Available from NTIS, PC A13/MF A01.

Several direct numerical simulations were performed and analyzed to study various aspects of the early development of mixing layers. Included are the phase jitter of the large-scale eddies, which was studied using a 2-D spatially-evolving mixing layer simulation; the response of a time developing mixing layer to various spanwise disturbances; and the sound radiation from a 2-D compressible time developing mixing layer.

3205 (N–89-24538, pp. 287-309) **Head-on collision of viscous vortex rings.** Stanaway, S. (Houston Univ., TX (USA)); Shariff, K.; Hussain, F. Stanford Univ., CA (USA). Dec 1988. (NASA-CR–184905;NAS–1.26:184905;SU-CTR-S–88;CONF-8806435–: Summer program on studying turbulence using numerical simulation databases, Stanford, CA (USA), 27 Jun - 22 jul 1988). In *Studying turbulence using numerical simulation databases, 2. Proceedings of the 1988 Summer Program.* Available from NTIS, PC A13/MF A01.

The head-on collision of two identical axisymmetric viscous vortex rings is studied through direct simulations of the incompressible Navier-Stokes equations. The initial vorticity distributions considered are those of Hill's spherical vortex and of rings with circular Gaussian cores, each at Reynolds numbers of about 350 and 1000. The Reynolds number is defined by Gamma/Nu, the ratio of circulation to viscosity. As the vortices approach each other by self-induction, the radii increase by mutual induction, and vorticy cancels through viscous cross-diffusion across the collision plane. Following contact, the vorticity distribution in the core forms a head-tail structure (for the cases considered). The characteristic time of vorticity annihilation is compared with that of a 3D collision experiment and 3D numerical simulations. It is found that the annihilation time is somewhat longer in the axisymmetric case than it is in the symmetry plane of the experiment and 3D numerical simulation. By comparing the annihilatiom time with a viscous timescale and a circulation timescale, it is deduced that both the strain rate due to local effects and to 3D vorticity realignment are important.

3206 (N–89-27115) **Calculation of turbulence-driven secondary motion in ducts with arbitrary cross section.** Demuren, A.O. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Jul 1989. 23p. (NASA-TM–102142;ICOMP–89-16;E–4941;NAS–1.15:102142). Available from NTIS, PC A03/MF A01.

Calculation methods for turbulent duct flows are generalized for ducts with arbitrary cross-sections. The irregular physical geometry is transformed into a regular one in computational space, and the flow equations are solved with a finite-volume numerical procedure. The turbulent stresses are calculated with an algebraic stress model derived by simplifying model transport equations for the individual Reynolds stresses. Two variants of such a model are considered. These procedures enable the prediction of both the turbulence-driven secondary flow and the anisotropy of the Reynolds stresses, in contrast to some of the earlier calculation methods. Model predictions are compared to experimental data for developed flow in triangular duct, trapezoidal duct and a rod-bundle geometry. The correct trends are predicted, and the quantitative agreement is mostly fair. The simpler variant of the algebraic stress model procured better agreement with the measured data.

3207 (UCRL–100847) **Time-dependent free convection in low Prandtl number fluids.** McClelland, M.A. Lawrence Livermore National Lab., CA (USA). 25 Oct 1989. 41p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-48. (CONF-891113–7: American Institute of Chemical Engineers annual meeting, San Francisco, CA (USA), 5-10 Nov 1989). Order Number DE90003053. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A numerical analysis is given for time-dependent free convection in a fluid with small Prandtl number. Consideration is given to a long two-dimensional cavity with vertical walls maintained at different temperatures. The results are relevant to the electron beam vaporization of liquid metals. The spatial problem is solved with the Galerkin finite element method, and a backward Euler method with step-size control is used to perform the time integration. For cases

involving large convection and numerical instabilities, streamwise diffusion is introduced with an approach sharing some features in common with the Taylor-Galerkin and Petrov-Galerkin methods. Solutions are given for a Prandtl number of 0.015 and Grashof numbers between 10^4 and 10^7, corresponding to the transition region between steady-state laminar and turbulent flow. The results reveal the effects of added streamwise diffusion along with mesh and time-step refinement. 17 figs.

3208 **Effect of density change on rapid liquid-solid interface kinetics and heat flow.** Richards, P.M. (Sandia National Labs., Albuquerque, NM (US)). pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

In this paper consequences of the need to transport density to or from a fast-moving liquid-solid interface are examined. There can be a severe limitation of the freezing velocity and a change in the amount of heat which must be conducted. The latter effect produces a net latent heat which can be significantly different from the equilibrium value and even change sign.

3209 **Comparisons of two-phase microgravity calculations using current and new flow regime maps in RELAP5.** Bagwell, T.G. (Texas A & M Univ., College Station (USA)); Hassan, Y.A.; Blanchat, T.K. *Transactions of the American Nuclear Society (USA),* 57: 176-177 (1988). (CONF-881011–: Joint meeting of the European Nuclear Society and the American Nuclear Society, Washington, DC (USA), 30 Oct - 4 nov 1988).

Recently, many experiments designed to quantify the parameters involved in microgravity two-phase flow have been performed. These experiments give significant insight to the differences between the flow regimes in 1-g and microgravity. However, the new correlations for pressure drop, heat transfer, and the flow regime maps are yet to be implemented into analytical methods. The purpose of this study is to model a KC-135 microgravity experiment, using the thermal-hydraulic does RELAP5/MOD2 and ATHENA. A comparison of these experimental results to code calculations from RELAP5/MOD2 and ATHENA is shown. Results show little difference between the ATHENA and the RELAP5 calculations. Also, modifications are made to the two-phase flow regime map in RELAP5 to model microgravity predictions. There is a substantial difference between the code's calculation before and after the changes were implemented. The heat transfer correlations of the code should be revised to take into account the effects of microgravity. Also, more data are needed for the verification of the microgravity transition criterion.

3210 **Viscosity of a phase-separating critical mixture.** Krall, A.H. (Univ. of Maryland, College Park (USA)); Sengers, J.V.; Hamano, K. *International Journal of Thermophysics (USA),* 10(2): 309-319 (Mar 1989). (CONF-880606–: 10. symposium on thermophysical properties, Gaithersburg, MD (USA), 20-23 Jun 1988).

Onuki has predicted the existence of a significant enhancement of the viscosity of a liquid mixture in the course of spinodal decomposition. The authors discuss a method to measure this effect in a critical mixture of isobutyric acid and water in which spinodal decomposition is induced by a pressure-quench technique. In addition, by varying the static pressure in the homogeneous phase, experimental information about the dynamic critical exponent for the viscosity is obtained.

3211 **Magnetically suspended centrifuge for studies of nonlinear phenomena in stratified fluids: Developmental aspects.** Gillies, G.T. (Department of Nuclear Engineering and Engineering Physics, University of Virginia, Charlottesville, Virginia 22901 (US)); Lawson, M.A.; Ritter, R.C.; Lawkins, W.F.; Thompson, S.; Sartory, W.K. *Review of Scientific Instruments (USA),* 60(10): 3293-3300 (Oct 1989). DOE Contract AC05-84OR21400.

Design studies of a novel magnetically suspended centrifuge suggest that such a device would be useful for investigating the nonlinear dynamics of interfacial waves in a rotating two-phase liquid. In its final form, the apparatus would use magnetic bearings, a directly-driven rotor, precision temperature control, and vibration isolation. The mechanical noise in the magnetic suspension coil of a preliminary apparatus was measured to be 3-μm rms in a 5-kHz bandwidth. However, these vibrations were attenuated by an active differentiator to the point where there was no observable oscillation in a 183-gram suspended test mass.

4205 Materials Testing

Refer also to citation(s) 2457, 2834, 2849, 3334, 4397, 4404, 4521

3212 (AD-A–211225/8/XAB) **Neutron-radiography system for field use. Final report.** Antal, J.J.; Marotta, A.S.; Farese, L.J. Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab. Jun 1989. 20p. (MTL-TR–89-52). Available from NTIS, PC A03/MF A01.

The use of neutrons as penetrating radiation expands the role of radiological nondestructive examination considerably. Radiological examination by neutrons has been limited, however, by the need to perform such radiography at the site of a nuclear reactor or a large accelerator system which can provide neutrons of an intensity equal to that of industrial X-ray sources. A mobile neutron radiological system has been designed as a prototype for the examination of lightweight aircraft structures in the field. The neutron source for this system is a very small commercially available (d,t) accelerator which provides an on-off radiation source and a size, weight, and shielding requirement acceptable for routine neutron examination in the manner of high-energy X-ray radiological systems. Under a variety of field maintenance conditions, this system has successfully provided useful neutron radiography at resonable exposure times and has pointed the way to a means for bringing neutron radiography to the worksite. In addition to the technological advances introduced, acceptance of this small source system as a nondestructive examination tool has required rethinking on the part of NDE professionals and reeducation of technicians regarding the goals of radiographic examinations. Experience with this unit, is reported both in the field and in the laboratory where it serves as a resource for further neutron-source developments and the exploration of new applications of on-site neutron radiological examinations.

3213 (CONF-890770–3) **Application of neutron diffraction NDE to high-temperature superconducting composites.** Kupperman, D.S.; Singh, J.P.; Majumdar, S.; Raptis, A.C.; Hitterman, R.L. Argonne National Lab., IL (USA). Aug 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Conference on review of progress in quantitative NDE; Brunswick, ME (USA); 23-28 Jul 1989. Order Number DE90002184. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Argonne Intense Pulsed Neutron Source and General Purpose Powder Diffractometer have been used to study high-$T_c$metal oxide composites composed of yttrium, barium, copper, oxygen, and silver. Neutron diffraction techniques were applied to composites with 15, 20, and 30% silver content by volume. We have observed that after sintering, the 30%-silver specimens contained both orthorhombic high-$T_c$and tetragonal, non-superconducting phases near the center of the specimens but only the orthorhombic phase near the surface. We have also observed residual tensile strains in Ag as a function of crystallographic direction; three strains range from as high as 0.085% in 15% Ag samples to as low as about 0.02% in a 30% Ag sample. Compressive strains in the YBCO (111) crystallographic direction were approximated by correcting for the diffraction peak shift due to changes in stoichiometry with varying Ag content. The estimated compressive-strain values vary from 0.04% (15% Ag) to 0.09% (20% Ag) to 0.01% (30% Ag), with an uncertainty of about 0.03%. The decrease in strain in YBCO for the 30% Ag composite is consistent with the decrease in Ag strain and may be due to additional creep of the composite. 11 refs., 3 figs.

3214 (CONF-8806370–) **The modeling of wear in energy conversion and utilization technologies: Proceedings.** Nichols, F.A.; Michaels, A.I.; Northcutt, L.A. (eds.). Argonne National Lab., IL (USA). Jun 1989. 182p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From International workshop on wear modeling: the modeling of wear in energy

conversion and utilization technologies; Argonne, IL (USA); 16-17 Jun 1988. Order Number DE90001889. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The proceedings of the Conference on Tribology in the area of Wear Life Prediction of Mechanical Components, at the General Motors Research Laboratories, sponsored by the Industrial Research Institute, were issued in 1985. Much discussion in the tribological community followed and resulted in the Workshop on the Use of Surface Deformation Models to Predict Tribology Behavior, held at Columbia University. The proceedings of that workshop were published under the tile of "Approaches to Modeling of Friction and Wear." Numerous recommendations were made by the various panels involved in the latter workshop concerning the modeling of tribological processes in general and wear processes in particular. Several factors were especially highlighted, namely the "need for a clearer understanding, sufficient data to evaluate the models, and the lack of alternative methods to obtain the desired information." The discussions and recommendations of the Columbia workshop provided a strong impetus for the present workshop. In parallel with that, a very significant publication appeared outside the usual tribology literature which offered the promise of an internally consistent methodology or framework for elucidating various wear mechanisms, tying together disparate data obtained with multitudinous wear-measuring apparatus under widely differing conditions, and applying test data so analyzed to real applications. Such correlations have eluded researchers for many years. 31 refs., 31 figs.

3215 (CONF-8905112–3) **A computer-controlled automated test system for fatigue and fracture testing.** Nanstad, R.K.; Alexander, D.J.; Swain, R.L.; Hutton, J.T.; Thomas, D.L. Oak Ridge National Lab., TN (USA). 1989. 31p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From ASTM symposium on the applications of automation technology to fatigue; Kansas City, MO (USA); 22-23 May 1989. Order Number DE90002931. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A computer-controlled system consisting of a servohydraulic test machine, an in-house designed test controller, and a desktop computer has been developed for performing automated fracture toughness and fatigue crack growth testing both in the laboratory and in hot cells for remote testing of irradiated specimens. Both unloading compliance and dc-potential drop can be used to monitor crack growth. The test controller includes a dc-current supply programmer, a function generator for driving the servohydraulic test machine to required test outputs, five measurement channels (each consisting of low-pass filter, track/hold amplifier, and 16-bit analog-to-digital converter), and digital logic for various control and data multiplexing functions. The test controller connects to the computer via a 16-bit wide photo-isolated bidirectional bus. The computer, a Hewlett-Packard series 200/300, inputs specimen and test parameters from the operator, configures the test controller, stores test data from the test controller in memory, does preliminary analysis during the test, and records sensor calibrations, specimen and test parameters, and test data on flexible diskette for later recall and analysis with measured initial and final crack length information. During the test, the operator can change test parameters as necessary. 24 refs., 6 figs.

3216 (PB–89-228290/XAB) **Computer-controlled test system for operating different wear-test machines.** Whitenton, E.P.; Ruff, A.W. National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (USA). Jul 1989. 50p. (NISTIR–89/4107). Available from NTIS, PC A03/MF A01.

This report discusses a wear-tester control system, where the same computer and software runs three different wear-test machines; a commercial crossed-cylinder, a commercial block-on-ring, and an in-house designed controlled-atmosphere tribometer. The computer hardware, the interface to the wear test machines, and the aspects that make the machines functionally similar are examined. The program itself, its use, and the data file structure are also explored.

3217 (PB–89-229025/XAB) **NDE (non-destructive evaluation) publications, 1985.** Mordfin, L. National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (USA). Office of Nondestructive Evaluation. Aug 1989. 43p. (NISTIR–89/4131). Available from NTIS, PC A03/MF A01.

See also PB–87-201406.

This report provides bibliographic citations, with selected abstracts, for 131 publications that appeared in the open literature, primarily during calendar year 1985. A detailed subject index is included as well as information on how copies of many of the publications may be obtained.

3218 (PB–89-872618/XAB) **Lubrication for high and extreme pressures. January 1974-September 1989 (Citations from Fluidex data base). Report for January 1974-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 135p. Available from NTISPC N01/MF N01.

Supersedes PB–88-853072.

This bibliography contains citations concerning extreme-pressure lubricants. Coverage includes methods and results of testing of extreme-pressure (EP) lubricants, measurement of properties and changes to these properties when EP lubricants are subjected to extreme pressures, additives and effects of additives to EP lubricants, and applications of EP lubricants. Some abstracts pertain to the sealing of lubricants and hydraulic fluids under extreme pressure conditions. Other citations refer to analysis of machine parts as part of the testing of EP lubricants, and effects of lubricant failure. (This updated bibliography contains 347 citations, 45 of which are new entries to the previous edition.)

3219 (PB–89-872824/XAB) **Lubrication for high and extreme pressures. January 1971-September 1989 (Citations from the US Patent data base). Report for January 1971-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 67p. Available from NTISPC N01/MF N01.

Supersedes PB–88-867577.

This bibliography contains citations of selected patents concerning compositions and applications of extreme pressure (EP) lubricants. The citations include compositions and methods of producing lubricant additives containing boron, sulfur, phosphorous, organic compounds, and metal complexes. Applications include lubricants for gears, metal working, wire drawing, vehicles, and machines. (This updated bibliography contains 152 citations, 27 of which are new entries to the previous edition.)

3220 (SAND–89-2198C) **Performance characteristics of a three-stage railgun.** Asay, J.R.; Hawke, R.S. Sandia National Labs., Albuquerque, NM (USA). [1989]. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8909229–2: Aeroballistic Range Association meeting, Paris (France), 24-28 Sep 1989). Order Number DE90002533. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Hypervelocity launchers are used to study the high-pressure equation of state of materials in regimes inaccessible by other methods. Two-stage light gas guns have been extremely useful for these applications, but have a practical velocity limit of about 8–9 km/s for impact studies. In this paper, we describe a three-stage launcher consisting of a two-stage light gas gun combined with a third-stage railgun, which overcomes previous velocity limitations pertaining to two-stage guns. This launcher is being developed for operation to 15 km/s and has achieved projectile velocities of 7.2 km/s to date. 10 refs., 9 figs., 1 tab.

3221 (UCRL–100810) **Hugoniot measurements with the LLNL electric gun facility.** Gathers, G.R.; Chau, H.H.; Osher, J.E.; Weingart, R.C. Lawrence Livermore National Lab., CA (USA). Jul 1989. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890812–62: American Physical Society topical conference on shock compression of condensed matter, Albuquerque, NM (USA), 14-17 Aug 1989). Order Number DE90002809. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A wide class of materials exists with properties that are not consistent enough to justify making very accurate EOS measurements. Some are nonhomogeneous two-phase materials consisting of a matrix and an embedded material. In order to represent these materials in hydrocode simulations, one is usually driven to substituting

another material which has (hopefully) similar properties. The Equation of State (EOS) of the material is usually the most important description needed. We have been developing a technique to make EOS measurements on such materials using the LLNL electric gun facility. 2 refs., 3 figs., 1 tab.

4208 Electronic Circuits and Devices

Refer also to citation(s) 2433, 2809, 2964, 2982, 3126, 3133, 3145, 3360, 3376, 4534

3222 (AD-A-210264/8/XAB) **Bias and oxide thickness dependence of trapped-charge buildup in MOS (metal oxide semiconductors) devices. Technical report.** Krantz, R.J.; Zietlow, T.C. Aerospace Corp., El Segundo, CA (USA). Electronics Research Lab. 31 Jan 1989. 27p. (TR-0089(4925-07)-1). Available from NTIS, PC A03/MF A01.

A rate equation for charge buildup, which includes sweep-out, hole /electron trapping, tunneling, recombination, and the effects of internal fields, is generalized to apply to negative gate biases and include electron injection from the silicon and aluminum gate interfaces. The dependence of the midgap voltage shift on oxide thickness is explicitly examined. The theoretical results are verified by comparison with experimental results obtained on p-type silicon test capacitors of different oxide thicknesses under varying positive and negative gate biases.

3223 (AD-A-210549/2/XAB) **Studies of high power density, pico-second rise-time light-activated semiconductor switch. Final report, 1 September 1987-31 December 1988.** Yu, P.L. California Univ., San Diego, La Jolla, CA (USA). Dept. of Electrical Engineering and Computer Sciences. 31 Dec 1988. 107p. Available from NTIS, PC A06/MF A01.

The carrier dynamics of the diode which is related to its electrical power switching behaviors is investigated in this program. A model is developed where the carrier transport and Maxwell equations are incorporated and self-consistent electrical-field profiles, current density and carrier are obtained in the PIN diode. Both low- and high-level optical excitations as well as low and high applied bias situations can be described by this model. The transient behavior of the diode switch at different optical energy levels is now well understood, while conventional theory for photodiodes at low-level excitation and at low bias cannot be applied to cases for high-level excitation and high bias. As a circuit element, the rise time of the switch under these circumstances depends on the time the internal field is cancelled out by mobile carriers generated. The predicted input-energy dependence and the transmission line impedance dependence of the rise time compare well with experimental results. The model also suggests the experimental configuration for obtaining power in the GW range. Finally, a preliminary investigation is made on the effects of avalanche multiplication on the performance of the diode switch.

3224 (DOE/BP/23169-2) **Adjustable speed drive study, June 1985-September 1988: Part 2, Appendices.** Wallace, A. Oregon State Univ., Corvallis, OR (USA). Dept. of Electrical and Computer Engineering. Aug 1989. 230p. Sponsored by U.S. DOE Management & Administration. DOE Contract AI79-85BP23169. Order Number DE90002771. Available from NTIS, PC A11/MF A01 - OSTI.

Advances in speed control for motors in recent years, notably those in power electronics, have widened the range of application for several adjustable speed drive (ASD) types to include the smaller horsepower sizes. The DC motor drive, formerly in almost universal use for speed control, is being challenged by the high efficiency induction motor/pulse width modulation (PWM) drive; and for special small horsepower size applications, by the permanent magnet motor/PWM inverter drive or by the switched reluctance motor drive. The main characteristics of the several ASD types suitable for small horsepower size applications are discussed, as well as their unwanted side effects: poor power factor, harmonic distortion of the supply, acoustic noise, and electromagnetic interference. A procedure is recommended for determining which, if any, ASD to use.

3225 (DOE/CE/34002-1) **Large signal nonlinear model of anisotropic transformers for nonsinusoidal operation: Final report, July 1, 1986-March 30, 1989.** Fuchs, E.F.; Masoum, M.A.S. Colorado Univ., Boulder, CO (USA). Sep 1989. 211p. Sponsored by U.S. DOE Conservation & Renewable Energy; National Science Foundation. DOE Contract FG02-86CE34002. ECS-8813405. Order Number DE90003259. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Single-phase, nonlinear, transformers with anisotropic iron cores are modeled for (non)sinusoidal excitations and (non)linear loads. The λ-i characteristics are computed based on design data through a quasi three-dimensional magnetic field analysis. This analysis includes the effects of the interlamination and butt-to-butt air gaps, the exchange of flux between any two neighboring anisotropic laminations and the influences of the end windings. It is shown that the B-H characteristics of cross- and with-grain iron core samples, obtained from Epstein measurements, must be modified for their application to anisotropic iron-cores. Therefore, these characteristics are used to compute through a quasi three-dimensional magnetic field analysis appropriate B-H characteristics for anisotropic iron core samples. Based on such newly defined B-H characteristics the λ-i functions representing the saturation-dependent leakage inductances are calculated from design data. 17 refs., 136 figs., 24 tabs.

3226 (SAND-89-0500) **Cure analysis of printed-circuit boards containing reactive adhesive layers.** Fullerton, R.; Roylance, D.K.; Allred, R.E.; Smith, A.E. Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE90001800. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report presents a method for analyzing the cure of multilayer printed-circuit (PC) boards containing chemically reactive adhesive inner layers. The cure kinetics of the adhesive are first measured by differential scanning calorimetry, using the method of Freeman and Carroll to obtain the numerical kinetic parameters. These parameters are then used in a finite-element model of the PC board that simultaneously solves the heat- and species-transfer equations. It is then possible to predict the temperature and extent of reaction at any time and position within the laminate, enabling the curing program to be optimized. 19 refs., 6 figs.

3227 (SAND-89-2542C) **Microwave coupling phenomenology of pc [printed-circuit] boards.** Bacon, L.D.; Riley, D.J.; Toth, R.P. Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891097-1: High powered microwave and broadband radio frequency propagation/phenomenology/methodology workshop, Livermore, CA (USA), 23-26 Oct 1989). Order Number DE90002576. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The final link in the High-Power Microwave (HPM) coupling chain is the distribution of energy on printed-circuit (pc) boards. This distribution is a critical part of the total problem, because the bottom line for damage or upset is what occurs at the component level. Like ports-of-entry (POE's), board coupling paths have their own transfer functions. Since most pc boards are not designed to operate at microwave frequencies, these transfer functions can be very complicated. In addition, active elements on the board are likely to make this part of the problem non-linear. 3 refs., 5 figs.

3228 **The radiation-hardened integrated circuit (RHIC) laboratory: Pursuit of Class 1. .** DeWitte, M.D. (Sandia National Labs., Albuquerque, NM (USA)). pp. 707 of Proceedings of the 9th international symposium on contamination control. International Environmental Sciences, Mt. Prospect, IL (1988). (CONF-880933-: 9. annual international symposium on contamination control: exploring world partnerships in technology, Los Angeles, CA (USA), 26-30 Sep 1988).

The Radiation-Hardened Integrated Circuit (RHIC) Laboratory is a research and development facility operated by Sandia National Laboratories for the Department of Energy. The facility is operated by the Center for Radiation-Hardened Microelectronics (CRM) and supports government clients with the rapid development and pilot production of radiation - hardened ULSI microelectronics. More than 25 years after Sandia's Willis Whitfield invented the first vertical

laminar flow clean room, Sandia National Laboratories has once again taken the lead in clean room technology with the design and construction of the RHIC facility. The building was designed to support wafer fabrication of ULSI integrated circuits through the 1990's. The facility consists of 12,000 s.f. (net) Ultra-Clean Room in a bay and chase configurations. The 174,000 s.f. building houses the majority of the Sandia CRM with 62,000 s.f. dedicated to office and light laboratory, 46,000 s.f. allocated for the clean room bay, chase and equipment repair/service area with the remaining 66,000 s.f. required for central plant and process support space.

3229 **The architectural ergonomics of Sandia's RHIC-II growing facility.** Miller, D.P. (Sandia National Labs., Albuquerque, NM (USA)). pp. 707 of Proceedings of the 9th international symposium on contamination control. Institute of Environmental Sciences, Mt. Prospect, IL (1988). (CONF-880933–: 9. annual international symposium on contamination control: exploring world partnerships in technology, Los Angeles, CA (USA), 26-30 Sep 1988).

Sandia National Laboratories is putting the finishing touches on its $26-million Radiation Hardened Integrated Circuits (RHIC-II) facility, and beginning to occupy the 5853 sq. meter (63,000 sq. ft.) light lab and office wing of the complex. During the next few months (March-July 1988), Sandia and its contractors will begin to occupy the heavy-lab wing, approximately 2973 sq. meters of which 1161 sq. meters is Class 10 clean room. Once fully occupied and operating, three shifts of approximately 45 process technicians will be working in the clean room. In order to maintain a Class-10 environment, clean room technicians will be required to wear special uniforms that filter the air exhaled by the wearer before passing it back into the clean room environment. This paper describes the uniforms and associated equipment, the gowning sequence, and the facility designed to accommodate convenient, contamination-free gowning.

3230 **Spectroscopic determination of the electrostatic potential profile in a plasma-prefilled ion diode.** Coleman, M.D. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853 (US)); Hammer, D.A. *Applied Physics Letters (USA),* 55(16): 1627-1629 (16 Oct 1989).

The electrostatic potential profile in the accelerating gap in a plasma-prefilled magnetically insulated intense pulsed ion beam diode has been determined using laser-induced fluorescence spectroscopy. Results for a 300–400 kV planar diode are presented, both with and without an electron emitting vane protruding from the cathode. In both cases, a 5–6 mm accelerating gap forms in the 10^{12}–10^{13}/cm^3 plasma in a few nanoseconds. The experimental potential profiles are not consistent with electrons confined to a sheath near the cathode. Rather, electrons are required throughout the gap to explain the observations.

3231 **Evaluation of a linear photodiode array detector for synchrotron small-angle x-ray scattering measurements.** Chu, B. (Department of Chemistry, State University of New York at Stony Brook, Stony Brook, New York 11794-3400 (US)); Wu, D.Q.; Howard, R.L. *Review of Scientific Instruments (USA),* 60(10): 3224-3230 (Oct 1989).

A linear photodiode array position-sensitive detector for synchrotron small-angle x-ray scattering was constructed by coupling a fiber-optic face plate coated with a thin layer (~40 μm) of phosphor (Y_2O_2S:Tb) onto an electrostatically focused, intensified photodiode array detector (EG&G, PARC, Model 1422) originally designed for visible light applications. The x-ray detector was thoroughly evaluated. It showed excellent linearity of response to the incident x-ray intensity (less than 1%), stable pixel uniformity (an average of ±5%), good spatial linearity (±1 per 100 pixels), and a net gain of ~17 counts/x-ray photon at 8 keV. The detector quantum efficiency was about 1 for a signal-to-noise ratio of greater than ~5%. No damage to individual pixels was found after exposure to a main beam of ~10^{10} x-ray photons/mm^2/s. A finite afterglow ($\gtrsim$5 s) was observed for the phosphor inside the intensifier tube. The afterglow that could limit fast time-resolved experiments could be significantly improved by replacing the present intensifier with one using a fast-decay phosphor. The detector usable length could be increased from the present 25 to 50 mm by replacing the fiber-optic face plate with a 2:1 taper.

3232 **Broadband cryogenic preamplifiers incorporating GaAs MESFETs for use with low-temperature particle detectors.** Lee, A.T. (Physics Department, Stanford University, Stanford, California 94305 (US)). *Review of Scientific Instruments (USA),* 60(10): 3315-3322 (Oct 1989).

Two voltage-sensitive preamplifier designs are presented for operation at 1.6 K. Both designs incorporate GaAs MESFETs (Plessy P35-1101). The first design has two stages including a common-source gain stage and a source follower stage. The noise performance, particularly with the low-frequency noise, was found to improve with cooling. The white-noise level at low temperature is 1 nV/Hz$^{1/2}$, and the low-frequency noise corner occurs at approximately 1 MHz. The voltage gain into 50 Ω is 7.0 dB, with the −3-dB point occuring at 10 MHz. The noise of the first stage was found to dominate the total noise at the output of a low-noise room-temperature post amplifier. The output impedance of the preamplifier is 50 Ω. The second design incorporates one cold FET, dissipating 1 mW, in cascode with a room-temperature bipolar transistor. The noise of this design was found to be approximately equal to that of the two-cold-stage design except for a bulge in the voltage noise centered at 13 MHz due to impedance mismatching of the line to room temperature. The gain of this design is 21 dB, with the −3-dB point at 2 MHz. Cryogenic semiconductor operation is discussed, design parameters of the two preamplifiers are discussed in detail, noise measurements are presented along with a discussion of the different temperature- and bias-dependent noise sources, and an analysis of the signal-to-noise ratio and rise time for the present detection scheme is made.

3233 **Niobium and niobium nitride contacts on semiconducting material.** Cukauskas, E.; Carter, W.; Pond, J.; Newman, H. To Department of the Navy, Washington, DC (USA). USA Patent Application 7-374,101. 30 Jun 1989. 19p. Available from NTIS, PC A03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

This invention related generally to a metallization layer of niobium or niobium nitride on a semiconductor in an integrated-circuit structure, which can function from the superconducting-temperature regime to above room temperature. Niobium or niobium nitride is deposited onto a heated gallium arsenide substrate. This metallization will maintain chemical stability after high-temperature post processing. These materials provide a low-resistivity metallization suitable for Schottky contacts used over a wide operating temperature range and are superconducting at low temperatures.

4209 Waste Processing Plants and Equipment

Refer also to citation(s) 2075

3234 (PB–89-222806/XAB) **Hybrid knowledge-based/algorithmic approach to the design of waste-treatment systems.** Rossman, L.A. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1989. 11p. (EPA–600/D-89/096). Available from NTIS, PC A03/MF A01.

Synthesizing a waste-water treatment system design involves selecting the combination, arrangement, and sizing of unit-treatment processes that will meet all treatment objectives. A computer-based method for the initial phase of treatment-system design is developed. It identifies arrangements of alternative unit processes whose overall performance index falls within a specified limit. The problem is approached using the artificial-intelligence paradigm of algorithmic state space search guided by knowledge-based heuristics. An experimental PROLOG program illustrates how the method may be implemented for a wide variety of waste-water-treatment design problems.

4210 Combustion Systems

Refer also to citation(s) 2152, 2612, 2924, 2925, 2926, 2927, 3195, 3196, 3197, 3198, 3199, 3200, 3201, 3202, 3466

3235 (ETDE-mf–0718075) **Determination of compatibility conditions of the burner/boiler system of heating equipment**

with a view to energy conservation by means of optimum adjustment of components. Final report. Pt. 3. Investigations of pressure swings in the starting process in a burner/boiler system. Melke, J.; Thomassen, S. Technischer Ueberwachungs-Verien Rheinland e.V., Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1987. 79p. (In German). BMFT 03E-8339A/7. Order Number DE90718075. Available from NTIS (US Sales Only), PC A05/MF A01.

The starting behaviour of a burner/boiler combination is to be considered from the aspect of energy saving and the reduction of harmful substances. Unburnt hydrocarbons and soot are produced in the ignition phase, so that the efficiency gradually drops due to deposits in the boiler. The aim of the investigation was to determine the relevant burner and boiler properties for the starting behaviour by measuring the pressure swings. Previous work of other authors, in which burner and boiler characteristics were defined was to be consulted. However, this preliminary invesigation showed that these figures do not apply clearly to burners or boilers. It is proposed that the method should be checked and possibly supplemented by new methods. (orig.) With 16 refs., 5 tabs., 32 figs.

3236 (N–89-17298) **Turbine Engine Hot Section Technology, 1987.** National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. 464p. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). Available from NTIS, PC A20/MF A01.

Presentations were made concerning the development of design analysis tools for combustor liners, turbine vanes, and turbine blades. Presentations were divided into six sections: instrumentation, combustion, turbine heat transfer, structural analysis, fatigue and fracture, surface protective coatings, constitutive behavior of materials, stress-strain response and life prediction methods.

3237 (N–89-17298, pp. 239-240) **Three-dimensional inelastic analysis methods for hot section components.** Todd, E.S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objective of this program is to produce a series of new computer codes that permit more accurate and efficient three-dimensional inelastic structural analysis of combustor liners, turbine blades, and turbine vanes. Each code embodies a progression of mathematical models for increasingly comprehensive representation of the geometrical features, loading conditions, and forms of nonlinear material response that distinguish these three groups of hot section components.

3238 (N–89-17298, pp. 241-248) **Three-dimensional inelastic analysis for hot section components, BEST 3D code.** Wilson, R.B. (State Univ. of New York, Buffalo (USA)); Banerjee, P.K. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The goal is the development of an alternative stress analysis tool, distinct from the finite element method, applicable to the engineering analysis of gas turbine engine structures. The boundary element method was selected for this development effort on the basis of its already demonstrated applicability to a variety of geometries and problem types characteristic of gas turbine engine components. Major features of the BEST3D computer program are described, and some of the significant developments carried out as part of the Inelastic Methods Contract are outlined.

3239 (N–89-17298, pp. 249-254) **Response characteristics of MHOST (MARC Hot-Section Technology) for 3-D inelastic analysis of hot-section components.** Shen, L.K. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The advantages of a newly developed code are demonstrated by comparisons of the analysis with existing theoretical data as well as with other available finite element programs. The new program shows promise to significantly reduce the computer time. It also permits accurate and efficient structural analysis of engine hot section components.

3240 (N–89-17298, pp. 255-257) **Mechanics of materials model.** Meister, J.P. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The Mechanics of Materials Model (MOMM) is a three-dimensional inelastic structural analysis code for use as an early design stage tool for hot section components. MOMM is a stiffness method finite element code that uses a network of beams to characterize component behavior. The MOMM contains three material models to account for inelastic material behavior. These include the simplified material model, which assumes a bilinear stress-strain response; the state-of-the-art model, which utilizes the classical elastic-plastic-creep strain decomposition; and Walker's viscoplastic model, which accounts for the interaction between creep and plasticity that occurs under cyclic loading conditions.

3241 (N–89-17298, pp. 259-265) **Component specific modeling.** Mcknight, R.L.; Tipton, M.T. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objective was to develop and verify a series of interdisciplinary modeling and analysis techniques specialized to address hot section components. These techniques incorporate data as well as theoretical methods from many diverse areas, including cycle and performance analysis, heat transfer analysis, linear and nonlinear stress analysis, and mission analysis.

3242 (N–89-17298, pp. 267-271) **Three-dimensional inelastic analysis methods for hot section components.** Lackney, J. (Sverdrup Technology, Inc., Cleveland, OH (USA)); Chamis, C.C. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objective was to develop analytical methods capable of evaluating the cyclic time dependent inelasticity which occurs in hot section engine components. Because of the large excursions in temperature associated with hot section engine components, the techniques developed must be able to accommodate large variations in material behavior including plasticity and creep. To meet this objective, a matrix consisting of three constitutive mode-element formulations was developed. A separate program for each combination of constitutive mode-element model was written. The source codes of the nine programs range in size from 7300 lines for the Bodner/twenty code to 19,000 lines for the Haisler and Allen/nine code. All the codes were given a stand alone capability of performing cyclic nonlinear analysis.

3243 (N–89-17298, pp. 273-279) **Constitutive modeling for isotropic materials.** Lindholm, U.S.; Chan, K.S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The fourth and final year of the HOST project with the initial objective of developing a unified constitutive model for finite element structural analysis of turbine engine hot section components is discussed. The final year's work was primarily concerned with the study of nonisothermal problems and the potential for thermal history effects to occur explicitly in the constitutive equations.

3244 (N–89-17298, pp. 335-348) **Finite element implementation of viscoplastic models.** Arya, V.K. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

A brief description of the implementation in MARK, the general purpose finite element structural analysis code, of two viscoplastic models developed by Robinson is given. One model is for isotropic materials and the other is for metal matrix composites. Also presented are analytical results obtained for hot section components using these models.

3245 (N–89-17298, pp. 349-356) **Structural response of an advanced combustor liner: Test and analysis.** Moorhead, P.E. (Sverdrup Technology, Inc., Cleveland, OH (USA)); Thompson, R.L.; Tong, M.; Higgins, M. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

An advanced (segmented) combustor liner supplied by Pratt and Whitney Aircraft was tested in the structural component test rig at Lewis Research Center. It was found that the segmented liner operated at much lower temperatures than the conventional liner (about 400 F lower) for the same heat flux. At the lower temperatures and low thermal gradients, little distortion to the segments was observed. The operating conditions were not severe enough to distort or damage the segmented liner.

3246 (N–89-17298, pp. 413-422) **Elevated temperature crack growth.** Kim, K.S.; Vanstone, R.H.; Malik, S.N.; Laflen, J.H. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The purpose is to determine the ability of currently available P-I integrals to correlate fatigue crack propagation under conditions that simulate the turbojet engine combustor liner environment. The utility of advanced fracture mechanics measurements will also be evaluated. Research showed that the experimentally measured displacements and loads can be accurately predicted by finite element analyses that consider the growth of the fatigue crack. These results are being used to evaluate nonlinear fracture mechanics parameters for correlating the observed fatigue crack growth rates for different strain ranges.

3247 (N–89-17298, pp. 423-434) **Creep fatigue life prediction for engine hot section materials (ISOTROPIC) fifth year progress review.** Nelson, R.S.; Harvey, P.R. National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The need for advanced life prediction methods for hot section components for gas turbine engines is becoming more and more evident. The complex local strain and temperature histories at critical locations must be accurately interpreted to account for the effects of various damage mechanisms and their possible interactions. This program is designed to investigate these fundamental damage processes, identify modeling strategies, and develop practical models which can be used to guide the early design and development of new engines and to increase the durability of existing engines.

3248 (N–89-28030) **Probabilistic structural analysis methods of hot engine structures.** Chamis, C.C.; Hopkins, D.A. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Jun 1989. 17p. (NASA-TM–102091;E–4855;NAS–1.15:102091;CONF-890612–: 34. international gas turbine and aeroengine congress and exposition, Toronto (Canada), 4-8 Jun 1989). Available from NTIS, PC A03/MF A01.

Development of probabilistic structural analysis methods for hot engine structures at Lewis Research Center is presented. Three elements of the research program are: (1) composite load spectra methodology; (2) probabilistic structural analysis methodology; and (3) probabilistic structural analysis application. Recent progress includes: (1) quantification of the effects of uncertainties for several variables on high pressure fuel turbopump (HPFT) turbine blade temperature, pressure, and torque of the space shuttle main engine (SSME); (2) the evaluation of the cumulative distribution function for various structural response variables based on assumed uncertainties in primitive structural variables; and (3) evaluation of the failure probability. Collectively, the results demonstrate that the structural durability of hot engine structural components can be effectively evaluated in a formal probabilistic/reliability framework.

3249 (PB–89-218242/XAB) **Recent developments of emission control technology in the United States for fossil fuel combustion sources.** Drehmel, D.C.; Sedman, C.B. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1989. 27p. (EPA–600/D-89/025). Available from NTIS, PC A03/MF A01.

This paper discusses control of air pollution from fossil-fuel combustion. Until recently, this meant abatement of smoke (particulate), sulfur dioxide, and oxides of nitrogen. With growing concern about global climate change, carbon dioxide has been added to the list. The paper includes discussions of such controls and control systems as wet and dry scrubbers, fabric filters, electrostatic precipitators, physical coal cleaning, flue-gas desulfurization, selective catalytic reduction, limestone-injection multistage burners, reburning, E-SOx and ADVACATE.

3250 (STEV-FBT–89-24) **Effect of reductive decomposition of $CaSO_4$ on sulphur capture in fluidised bed boilers.** Lyngfelt, A.; Leckner, B. Statens Energiverk, Stockholm (Sweden). 1989. 11p. (CONF-890402–8: 10. international conference on fluidized-bed combustion, San Francisco, CA (USA), 30 Apr - 3 may 1989). Order Number DE90719434. Available from NTIS (US Sales Only), PC A03.

The effect of limestone addition on sulphur capture and NO emissions has been studied in a stationary and a circulating fluidised bed boiler (FBB). Significant differences between the two boilers were observed, both with respect to sulphur capture and NO emission behaviour. In the stationary FBB sulphur retention exhibits a strong temperature dependence as opposed to the circulating FBB. Furthermore the sulphur capture performance is much more effective in the circulating FBB. In the circulating FBB limestone addition resulted in a considerable increase of NO emission, whereas no effect of limestone was seen in the stationary FBB for the same type of coal. For a low volatile fuel, however, limestone addition gave a considerable decrease of NO emission in the stationary FBB. These results can be explained by the sorbent particles being exposed to reducing conditions in the particle phase of the stationary FBB. (orig.) 21 refs., 9 illustrations.

3251 (VTT-TIED–944) **Qualitative modeling and control of combustion.** Lilja, R.; Oliut, M.; Heinonen, R. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Feb 1989. 50p. (In Finnish). Order Number DE90719342. Available from NTIS (US Sales Only), PC A03/MF A01.

The increasing use of fossil fuels with more restrictive emission limits have created the need to improve the control process in combustion chambers. This report presents the background data of the opportunities for improving combustion control by using in a new way numerical simulation, knowledge technique, picture information taken with a furnace camera and new control algorithms.

3252 (VTT-TIED–985) **Electricity production at fuel cell power plants.** Leppaelahti, J. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). May 1989. 73p. (In Finnish). Order Number

DE90719337. Available from NTIS (US Sales Only), PC A04/MF A01.

A report of the NEMO-Research Program.

The essentially higher efficiency of electricity production is the most significant advantage of the fuel cell power plant compared to the conventional power plants. The maximum efficiency obtained in techno-economic estimates has been about 55%. The operation of the fuel cell power plant requires the feed of clean fuel gas into the fuel cell. As a consequence of this and of the character of the oxidation reaction, the flue gas emissions from this power plant type are very low. However, a number of technicca problems should be solved until a large-scale fuel cell power plant can be constructed. The maximum total efficiency of electricity production can be achieved only at power plants based on fuel cells operable at high temperatures. The advancement of these cell types to a commercial level will, however, require a lot of technical development. It is expected that cell types operable at low temperatures and suited for power plants will be introduced into the market during the next few years. Due to the low operation temperature, the waste heat developed by these is more difficult to utilize than that of the fuel cells operating at high temperatures, and hence, the efficiency of these power plants will remain lower. The fuel cell power plant also requires the development of fuel processing methods. Requirements of new type will be set on gasification processes of solid fuels and on gas clean-up. The processing of natural gas for fuel cells should also be developed.

3253 (VTT-TUTK–990) **Sonic pyrometry in furnaces. Fundamentals.** Martikainen, P. Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). 1989. 80p. (In Finnish). Order Number DE90719335. Available from NTIS (US Sales Only), PC A05/MF A01.

A research report of the Liekki-research program.

Mean gas temperature measurement between a transmitter and a receiver can be based on propagation velocity of sound waves. To use this measurement technique, molecular weight and specific heat ratio data of the intermediate gas must be known. At applications in dilute suspensions some modifications of these parameters can be utilized. In the presence suspended particles, oxidizing soot particles and chemical reactions, sound velocity depends on frequency. At furnace temperature measurements the frequency range about 0.5-3 kHz is mostly utilized. Usually six to eight transceivers are installed on the perimeter of a furnace. A temperature distribution of the measurement plane can be constructed on the basis of single travel times and corresponding mean temperatures between acoustic transducers. The acoustic measurements have a rather good agreement with water-cooled high velocity thermocouple probes. An acoustic pulse of high sound pressure level is generated with an electromagnetic transducer or with an electric discharge across a pair of electrodes. Utilizing an electrodynamic transducer the acoustic pulse is more controllable, e.g. chirp pulse compression is possible.

4220 Underground Engineering

3254 (PB–89-218481/XAB) **Liquefaction hazards and their effects on buried pipelines. Technical report.** O'Rourke, T.D.; Lane, P.A. National Center for Earthquake Engineering Research, Buffalo, NY (USA). 1 Feb 1989. 197p. (NCEER–89-0007). Available from NTIS, PC A09/MF A01.

This research involves the evaluation of liquefaction-induced ground movements and their effects on buried pipelines. The work is divided into three components: review of liquefaction phenomena and associated ground displacements; characterization of liquefaction-induced lateral spreading through observations and measurements of lateral spread deformations during past earthquakes; parametric study to evaluate buried pipeline response as a function of soil properties and geometric characteristics of lateral spreads. Case studies of four earthquakes were reviewed in which occurrences of lateral spreading have been reported. The results of the case studies indicate a close relationship between geologic and morphologic conditions and the occurrence and pattern of lateral spreading. The parametric study demonstrates the strong influence of geometric characteristics of the soil displacements on buried pipeline response. The delineation of zones of potentially large ground movement and the estimation of displacement patterns can be useful in the design of future pipeline systems, and the modification of existing ones, to limit earthquake damage.

4230 Marine Engineering

3255 (AUC-IBT-R–8722) **Applications of structural systems reliability theory in offshore engineering. State-of-the-art.** Structural Reliability Theory. Paper, 35. Thoft-Christensen, P. Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik. Sep 1987. 25p. (CONF-8709477–: International symposium on integrity of offshore structures, Glasgow (UK), Sep 1987). Available from Available on loan from Risoe Library, DK-4000 Roskilde.

Structural Reliability Theory. Paper, 35.

In this paper the latest developments in structural systems reliability are reviewed and discussed from the point of view of application in offshore engineering. It is concluded that structural systems reliability is now developed to such a level that some applications in offshore engineering are possible. However, more research is needed before extensive use can be expected. (author) 18 refs.

4240 Pollution Control Equipment

Refer also to citation(s) 2048, 2075

3256 (PB–89-222681/XAB) **Quantitative evaluation of air-filtration systems in use at asbestos abatement sites: Research in progress.** Powers, T.J.; Cain, W.C.; Wilmoth, R.C.; Kominsky, J.R.; Brownlee, J.A. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1989. 17p. (EPA–600/D-89/056). Available from NTIS, PC A03/MF A01.

High Efficiency Particulate Air (HEPA) filtration systems serve as the principal engineering control to remove asbestos particulate from airstreams at abatement projects. However, little quantitative information is available on the integrity of these air-filtration systems in preventing asbestos fiber release into outdoor air or adjacent building areas, potentially exposing occupants. A study is in progress to assess the performance of HEPA filtration systems in use at asbestos abatement projects to determine each systems operating particle-removal efficiency, percent concentration, and decontamination factor. The asbestos-fiber concentration in the inlet and discharge air of each filtration system will be determined by isokinetic air sampling. Each isokinetic air sample collected will be analyzed using transmission electron microscopy. In addition, in-place aerosol performance testing will be conducted according to procedures outlined in ANSI/ASME N510-1980. The test method utilizes a polydispersed dioctyl phthalate aerosol (generated by Laskin nozzles) and a photometric light-scattering mass-concentration detector as the measuring device.

3257 (PB–89-235899/XAB) **Method for measuring the effectiveness of gaseous-contaminant removal filters.** Mahajan, B.M. National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Building Environment Div. Aug 1989. 54p. (NISTIR–89/4119). Available from NTIS, PC A04/MF A01.

See also PB–88-155882.

The report presents a brief review of the gas-adsorption kinetics theory applicable to adsorption of gaseous contaminants by filter media, and an algorithm for assessing the effectiveness of filtering devices with flow bypass. It briefly describes the selected testing technique for measuring the effectiveness of filter media, and presents experimental data for adsorption of n-butane, toluene, and carbon monoxide.

4250 Power Cycles

Refer also to citation(s) 2906

43 PARTICLE ACCELERATORS

Refer also to citation(s) 3942, 4491

3258 (BNL–43394) **The evolution of high energy accelerators.** Courant, E.D. Brookhaven National Lab., Upton, NY (USA).

Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90003260. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Lecture for Goudsmit Professorship, University of Michigan, October 11, 1989.

In this lecture I would like to trace how high energy particle accelerators have grown from tools used for esoteric small-scale experiments to gigantic projects being hotly debated in Congress as well as in the scientific community.

3259 (LBL–27000) **Accelerator and Fusion Research Division: 1988 summary of activities.** Lawrence Berkeley Lab., CA (USA). May 1989. 124p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90002618. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The Accelerator and Fusion Research Division is not only the largest scientific division at LBL, but also one of the most diverse. Major efforts include: investigation in both magnetic and inertial-confinement fusion; design and construction of the Advanced Light Source, a state-of-the-art synchrotron-radiation facility; research into advanced applications and instrumentation at the Center for X-Ray Optics; theoretical studies of accelerator phenomena and characteristics; research and development in support of the Superconducting Super Collider and other high-energy accelerators; operation of a large accelerator complex, the Bevalac, for nuclear science and biomedical research. Research in these areas is summarized in this report.

4301 Design, Development, and Operation

Refer also to citation(s) 3158, 3159, 3167, 3318, 3330, 3619, 3968, 4438

3260 (ANL-HEP-CP–89-122) **Hedron collider physics at Fermilab.** Nodulman, L.J. Argonne National Lab., IL (USA). 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-890903–2: International Europhysics conference on high-energy physics, Madrid (Spain), 7-14 Sep 1989). Order Number DE90003384. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The hadron collider physics program at Fermilab, Tevatron-I, has recently provided considerable data samples to two high beta experiments as well as one low beta general purpose Collider Detector at Fermilab (CDF). A brief description of the Tevatron collider and the high beta experiments is followed by a discussion of hard scattering results from CDF. The prospects for growth in this exciting physics program are outlined. 20 refs., 29 figs., 1 tab.

3261 (BNL–43281) **High energy heavy ion collisions and the RHIC [Relativistic Heavy Ion Collider] project at Brookhaven.** Ludlam, T.W. Brookhaven National Lab., Upton, NY (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8905143–20: NATO advanced study institute international advanced course on the nuclear equation of state, Peniscola (Spain), 12 May - 3 jun 1989). Order Number DE90002293. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The most spectacular of the new high energy approaches to nuclear physics is the field of relativistic heavy ion collisions, for which it is anticipated that construction of the Relativistic Heavy Ion Collider (RHIC) facility will begin soon. Here the goal is to subject large volumes of nuclear matter to such extreme conditions of temperature and pressure that a new form of matter is produced in which the recognizable components are not the familiar neutrons and protons, but are quarks. This paper discusses the RHIC project of the experiments and detectors associated with it. 10 refs., 4 figs.

3262 (IC–89/170) **Wakefield accelerator in a magnetized electron-positron plasma.** Mofiz, U.A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 7p. Order Number DE90608630. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A short pulse of intense electromagnetic radiation may excite large amplitude wakefields (E>1 Gev/m) in a magnetized electron-positron plasma and consequently, electron or positron bunches may be accelerated to high energies. Such a mechanism exists in the pulsar magnetosphere and its realization in the laboratory may accomplish the promising method for the generation of high energy accelerators. (author). 12 refs.

3263 (INIS-mf–12013, pp. 1-6) **Tandem accelerators.** Duerr, W.; Heck, R.; Horn, K.; Jaeschke, E.; Kandler, H.; Kraemer, D.; Koessler, V.; Pfahler, R.; Repnow, R.; Schmidt, H. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

At the EN accelerator the demand for voltages higher than 3 MV was decreased. For long periods of time the machine was operated with reduced gas pressure to allow corona regulation down to terminal voltages less than 200 kV. However, the charging belt had to be replaced, which had been in service for 14000 hours. The performance of prototypes of D-type resistors installed in the EN-column was highly satisfying. The conductive drive sheaves of the pelletron of the MP-tandem-accelerator had to be removed before operational experience could be gathered because of warnings received from the manufacturer. Tube section no. 5 was replaced after 40000 hours of operation after a fissure was discovered in a glass insulator. Internal tracks due to electrical discharges were discovered across two other tube insulators, which had to be shorted out. The failure of a tooth belt in the rotating shaft system caused an additional tank opening, and an overheated high voltage bushing of the ICT caused some additional down-time of the MP. Two additional column sections were equipped with D-type grading resistors of the Strasbourg-design. Six new ion species - mainly rare earth isotopes - were provided for experiments. The high current sputter source MISS was further improved, especially with respect to pulsed mode operation. Consequently a beam with a peak electrical current of 240 μA ^{16}O was analyzed behind the MP during a source test experiment. (orig.).

3264 (LBL–27001) **Center for X-ray Optics, 1988.** Lawrence Berkeley Lab., CA (USA). Apr 1989. 24p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. F49620-87-K-0001. Order Number DE90003300. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report briefly reviews the following topics: soft-x-ray imaging; reflective optics for hard x-rays; coherent XUV sources; spectroscopy with x-rays; detectors for coronary artery imaging; synchrotron-radiation optics; and support for the advanced light source.

3265 (LBL–27649) **The challenges of third-generation synchrotron light source.** Jackson, A. Lawrence Berkeley Lab., CA (USA). Aug 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (ESG–78;CONF-890803–37: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order Number DE90002461. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Third-generation synchrotron light sources are specifically designed to operate with long insertion devices that produce very high brightness beams of synchrotron radiation. There are many such facilities now under construction, or in the design stage, all over the world. After a brief review of the main properties of the low emittance storage rings that form the heart of these facilities, we will discuss the particular challenges that accompany their design. These include: the effects of the strong sextupoles required for chromatic correction of the low emittance lattices; impact of machine imperfections on the dynamic aperture; the effects of the linear and nonlinear magnetic fields of the undulators; impedance consequences of long, narrow, undulator vacuum vessels; injection; and beam lifetime. As examples, we take the Advanced Light Source, currently under construction at the Lawrence Berkeley Laboratory, USA, and the European Synchrotron Radiation Facility under construction in Grenoble, France. 8 refs., 8 figs., 1 tab.

3266 (LBL–27763) **Challenges for utilization of the new synchrotron facilities.** Attwood, D. Lawrence Berkeley Lab., CA (USA). Aug 1989. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890802–16: 7. synchrotron radiation instrumentation (SRI) national conference,

Berkeley, CA (USA), 6-10 Aug 1989). Order Number DE90002451. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The emergence of third generation synchrotron radiation facilities provides new scientific opportunities and challenges. Optimized for small phase space electron beams, long periodic magnet structures, and dedicated scientific user access – these new machines promise significant increases in spectral brightness, as well as enhanced spatial and temporal coherence properties, which translates to new opportunities for combining high spatial and spectral resolution. The challenges to the machine builders are well known: designing and maintaining the small phase space beams, constructing long magnet structures with minimal errors, stabilizing the beam to long and short term fluctuations, and multiple undulator tuning, to name a few. The challenges in beamline optics, spectroscopic and focusing systems are also quite clear. The issue of optical stability quickly comes to the forefront as we attempt to focus and image to ever finer spatial scales, with minimal loss of photon flux. Surface figure and polish are of greater importance, as is minimization of aberrations, as we strive to maintain these small phase space photon beams. The higher intensities and power loading mandate cooled, or cleverly controlled optics, to avoid thermal distortion. Spectroscopic efficiency, with minimal wavefront distortion to the near diffraction limited radiation, becomes more important, as do order and harmonic suppression resolution are called for – with both diffractive and reflective optics. Two of our major issues will be efficient time sharing of these valuable resources, relegating time consuming setup procedures to branch lines while others take data, and controlling the cost of these ever more complex beamline engineering systems. 12 refs., 6 figs., 8 tabs.

3267 (UCRL–101915) **Induction linear accelerators for commercial photon irradiation processing.** Matthews, S.M. Lawrence Livermore National Lab., CA (USA). 13 Jan 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890604–20: Annual meeting of the American Nuclear Society, Atlanta, GA (USA), 4-8 Jun 1989). Order Number DE90002975. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A number of proposed irradiation processes requires bulk rather than surface exposure with intense applications of ionizing radiation. Typical examples are irradiation of food packaged into pallet size containers, processing of sewer sludge for recycling as landfill and fertilizer, sterilization of prepackaged medical disposals, treatment of municipal water supplies for pathogen reduction, etc. Volumetric processing of dense, bulky products with ionizing radiation requires high energy photon sources because electrons are not penetrating enough to provide uniform bulk dose deposition in thick, dense samples. Induction Linear Accelerator (ILA) technology developed at the Lawrence Livermore National Laboratory promises to play a key role in providing solutions to this problem. This is discussed in this paper.

3268 **Operational experience with Tevatron I antiproton source.** McCarthy, J.D. (Fermi Nat. Lab., Batavia, IL (US)). pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). (CONF-870302–: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

The Fermilab antiproton source consist of five beamlines, a targetting station and two storage rings. The beam is extracted fr the Main Ring at 120 GeV from F-17 and transported up AP-1. At AP-0 they are targetted on a 7cm copper (5cm) target. The antiprotons are collected at 8 GeV with a 15 cm long lithium lens of 1 cm radius operating at 800 T/m gradient.

3269 **Overview of recent focussing horns for the BNL neutrino program.** Carroll, A. (AGS Dept., Brookhaven National Lab., Upton, NY (US)); Leonhardt, W.; Monaghan, R.; Peason, C.; Pendzick, A.; Ryan, G.; Sandberg, J.; Sims, W.; Smith, G.; Stillman, P. pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. IEEE Service Center, Piscataway, NJ (1987). (CONF-870302–: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

In this paper the authors present an overview of the two magnetic focussing horn systems recently constructed, installed, and operated in the fast extracted beam for the neutrino physics program at the AGS. These horn systems consist of a number of interrelated subsystems which operate together to produce a very intense, parallel beam of pions. Both horn systems built had the same overall features, but the broad band system focussed pions over as large a momentum band as possible to maximize the neutrino flux. A synopsis of the design concepts and critical engineering requirements is given.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 3269, 4455

3270 (INIS-mf–12013, pp. 114-115) **Beam crystallization.** Habs, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Guhr, T.; Hartmann, U.; Weidenmueller, H.A.; Hecht, K.T.; Kremer, K. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The eigenvalues and eigenmodes of helical beam crystals in a simple harmonic focussing field have been calculated, applying the group theoretical approach of molecular physics, leading to a simple diagonalization of 3x3 matrices. (orig.).

3271 (LA-UR–89-3600) **The design and performance of the FNAL high-energy polarized beam facility.** Tanaka, Nobuyuki. E-581/704 Collaboration. Los Alamos National Lab., NM (USA). [1989]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8910121–1: 6. topical conference on physics with polarized beams on polarized targets, Spencer, IN (USA), 16-18 Oct 1989). Order Number DE90002409. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We describe a new polarized-proton and -antiproton beam with 185-GeV/c momentum in the Fermilab MP beam line which is currently operational. The design uses the parity-conserving decay of lambda and antilambda hyperons to produce polarized protons and antiprotons, respectively. A beam-transport system minimizes depolarization effects and uses a set of 12 dipole magnets that rotate the beam-particle spin direction. A beam-tagging system determines the momentum and polarization of individual beam particles, allowing a selection of particles in definite intervals at momentum and polarization. We measured polarization of the beam by using two types of polarimeters, which verified the determination of polarization by a beam-particle tagging system. Two of these processes are the inverse-Primakoff effect and the Coulomb-nuclear interference (CNI) in elastic proton-proton scattering. Another experiment measured the π^0 production asymmetry of large-x_F values; this process may now be used as an on-line beam polarimeter. 9 refs., 9 figs.

3272 (LBL–27765) **A study of phase control in the FEL [free electron laser] two-beam accelerator.** Sessler, A.M.; Whittum, D.H.; Wurtele, J.S. Lawrence Berkeley Lab., CA (USA). Aug 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890803–38: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order Number DE90002681. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A formalism is developed for the analysis of a steady-state free electron laser (FEL) and is applied to the two-beam accelerator (TBA). Conditions are derived for the design of a FEL TBA with rf output power and phase insensitive to errors in both beam current and energy. An example is presented of a suitably phase insensitive TBA design with 100 reaccelerations employing untapered FEL sections and with low power rf input to each section. The theoretical analysis is confirmed by a single particle FEL simulations. 9 refs., 2 tabs.

3273 (LBL–27766) **General properties of an asymmetric B-factory lattice.** Autin, B. Lawrence Berkeley Lab., CA (USA). Aug 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890803–41: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order

Number DE90002678. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The type of collider considered for the production of B mesons consists of two rings in which unequal energy beams circulate. Criteria based on the beam-beam interaction are formulated and it is shown that they are consistent with lattices in which the synchrotron radiation occurs in the bending magnets only. However, the requirements imposed on the low energy ring dipole field and RF power may require the addition of horizontal wigglers in zero dispersion sections to control the damping time and of vertical wigglers in finite dispersion regions to adjust the shape of the beam at the crossing point. 9 refs., 1 fig.

3274 (SAND–89-2629C) **RLA simulations.** Wagner, J.S. Sandia National Labs., Albuquerque, NM (USA). [1989]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8909216–8: DARPA/SDIO service annual charged particle beam review, Monterey, CA (USA), 18-21 Sep 1989). Order Number DE90002581. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Preliminary BUCKSHOT simulations of a recirculating linear accelerator have been made. Two accelerator configurations have been examined for a variety of beam currents (10-40 kA). The first configuration is an attempt to simulate conditions accessible to near-term experiments. The second configuration tries to mock up a next generation application type machine. 3 figs.

3275 (SAND–89-7141C) **Summary of RLA [Recirculating Linear Accelerator] beam transport experiments using a 1.5 MV injector.** Haworth, M.D.; Platt, R.C.; Smith, D.L.,; Mazarakis, M.G.; Poukey, J.W.; Leifeste, G.T.; Hasti, D.E.; Bennett, L.F.; Lucero, S.J. Sandia National Labs., Albuquerque, NM (USA). [1989]. 4p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. 145-SNL-1-8-1;63-9595. (CONF-8909216–10: DARPA/SDIO service annual charged particle beam review, Monterey, CA (USA), 18-21 Sep 1989). Order Number DE90002583. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Beam transport experiments on Sandia's Recirculating Linear Accelerator (RLA) using a 1.5-MV injector with and without an additional 1.0 MV of acceleration provided by the ET-2 accelerating cavity were concluded this year. Our experimental results show that an injected beam of only 1.5 MeV requires too large an f-value in the IFR channel to effectively propagate a 10-kA beam. Dramatic improvement in current transport was seen for the higher-γ 2.5 MeV beam. Based on these results plus computer simulation results, the 4.0 MeV IBEX accelerator is now being used as the RLA injector. 10 refs., 7 figs.

3276 (SLAC/AP–76) **Optimizing the average longitudinal phase of the beam in the SLC linac.** Bane, K.L.F. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Sep 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90002803. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The relation of the beam's average linac phase, ϕ_0, to the final energy spectrum in the SLC linac has been studied by many people over the years, with much of the work left unpublished. In this note we perform a somewhat thorough in vestigation of the problem. First we describe the calculation method, and discuss some common features of the energy spectrum. Then we calculate the value of ϕ_0 that minimizes δ_{rms} for the conceivable range of bunch population and bunch lengths of the SLC linac. This is followed by luminosity calculations, including the sensitivity of luminosity to variations in ϕ_0. Finally we suggest a practical method of implementing the proper phase setting on the real machine.

3277 (SLAC-PUB–5060) **An adiabatic focuser.** Chen, P.; Oide, K.; Sessler, A.M.; Yu, S.S. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Aug 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515;AC03-76SF00098;W-7405-ENG-48. (LBL–27608;CONF-890803–40: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order Number DE90001816. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Theoretical analysis is made of an intense relativistic electron beam, such as would be available from a linear collider, moving through a plasma of increasing density, but density always less than that of the beam (underdense). In this situation, the plasma electrons are expelled from the beam channel and the electrons are subject to an ever-increasing focusing force provided by the channel ions. Analysis is made on the beam radiation energy loss in the classical, the transition, and the quantum regimes. It is shown that the focuser is insensitive to the beam energy spread behaviors in the nonclassical regimes, the radiation limit on lenses (the Oide limit) can be exceeded. The sensitivity of the system to the topic mismatch and the nonlinearity is also analyzed. Examples are given with SLC-type and TLC-type parameters. 9 refs., 1 tab.

3278 (SLAC-PUB–5086) **Coherent pair creation from beam-beam interaction.** Chen, Pisin. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Sep 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890803–39: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order Number DE90001817. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

It has recently been recognized that in future linear colliders, there is a finite probability that the beamstrahlung photons will turn into e^+e^- pairs induced by the same beam-beam field, and this would potentially cause background problems. In this paper, we first review the probability of such a coherent pair creation process. It is seen that the constraint on the beamstrahlung parameter, Υ, is tight of these coherent pairs to be totally suppressed. We then point out that there exists a minimum energy for the pair-created particles, which scales as $\sim 1/5\Upsilon$. When combining this condition with the deflection angle for the low-energy particles, the constraint on the allowable Υ value is much relaxed. Finally, we calculate the effective cross section for producing the weak bosons by the low-energy e^+e^- pairs. It is shown that these cross sections are substantial for $\Upsilon > 1$. We suggest that this effect can help to autoscan the particle spectrum in the high energy frontier. 10 refs., 2 figs.

3279 (UCRL–21249) **A photon accelerator.** Wilks, S.C.; Dawson, J.M.; Mori, W.B.; Katsouleas, T.; Jones, M.E. Lawrence Livermore National Lab., CA (USA). 1989. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90002827. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A novel method of frequency upshifting short ($\lesssim 100\mu s$) pulses of laser light, which makes use of relativistic plasma waves, is described. As is well known, photons in a plasma can be thought of as particles possessing and effective mass of $m_\gamma = \hbar\omega_{pe}/c^2$ and moving with the group velocity of the laser pocket. It is also known that these photons experience a force acting on them when in the presence of a gradient in the plasma density. By using a relativistic plasma wave traveling with the photons, the energy of the photons (thus the frequency) can be continuously increased. Similarities with another laser-plasma interaction, Raman scattering, are discussed. The physical mechanism and results of particle-in-cell computer simulations will be described. 9 refs., 3 figs.

3280 **A raster scanning power supply system for controlling relativistic heavy ion beams at the Bevalac biomedical facility.** Stover, R. (Lawrence Berkeley Lab., Berkeley, CA (US)); Nyman, M.; Halliwell, J.; Lutz, I.; Dwinell, R. pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC03-76SF00098. (CONF-870302–: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

A power supply system is currently being designed and constructed to sweep an 8.0 Tesla-meter relativistic heavy ion beam in a raster scanning mode for radiotherapy use. Two colinear dipole magnets with orthogonally oriented magnetic fields are driven by the system to produce a rectangular field (40 x 40 cm max.) with a uniform dose (+-2.5%) to a target volume 6 meters away. The fast horizontal scanning magnet is driven by a single power supply which in conjunction with a triac bridge network and a current regulated linear actuator produces a 1200 cm/sec max. sweep rate The slow (40 cm/sec) vertical scanning magnet is controlled by dual current regulated linear actuators in a push-pull configuration. The

scanner system can provide off-axis treatment profiles with large aspect ratios of unusual dimensions.

3281 First test of the Siberian snake magnet arrangement to overcome depolarizing resonances in a circular accelerator. Krisch, A.D. (Randall Laboratory of Physics, The University of Michigan, Ann Arbor, Michigan 48109 (US)); Mane, S.R.; Raymond, R.S.; Roser, T.; Stewart, J.A.; Terwilliger, K.M.; Vuaridel, B.; Goodwin, J.E.; Meyer, H.; Minty, M.G.; and others. *Physical Review Letters (USA)*, 63(11): 1137-1140 (11 Sep 1989).

We studied the $G\gamma=2$ imperfection depolarizing resonance at 108 MeV, both with and without a Siberian snake, by varying the resonance strength while storing beams of 104- and 120-MeV polarized protons at the Indiana University Cooler Ring. We used a cylindrically symmetric polarimeter to simultaneously study the effect of a depolarizing resonance on both the vertical and radial components of the polarization. AT 104 MeV we found that the Siberian snake eliminated the effect of the nearby $G\gamma=2$ depolarizing resonance.

3282 Classification of beam breakup instabilities in linear accelerators. Lau, Y.Y. (Beam Physics Branch, Plasma Physics Division, Naval Research Laboratory, Washington, D.C. 20375-5000 (US)). *Physical Review Letters (USA)*, 63(11): 1141-1144 (11 Sep 1989).

With the use of a standard model, beam breakup growths in all types of linacs are shown to be classified by only two dimensionless parameters which depend on the beam current, beam energy, pulse length, machine length, breakup mode frequency, focal strength, and transverse shunt impedance. This classification suggests that rf cure plays a more important role in the control of beam breakup than focusing in a long pulse beam. The converse holds for a short pulse beam.

4303 Auxiliaries and Components

Refer also to citation(s) 3128, 3157, 3268

3283 (BNL–43344) **Infra-red synchrotron radiation measurements at Brookhaven.** Williams, G.P.; Hirschmugl, C.J.; Kneedler, E.M.; Sullivan, E.A.; Siddons, D.P.; Chabal, Y.J.; Hoffmann, F.; Moeller, K.D. Brookhaven National Lab., Upton, NY (USA). 30 Sep 1988. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8808141–15: 3. international conference on synchrotron radiation instrumentation, Tsukuba (Japan), 29 Aug - 2 sep 1988). Order Number DE90002302. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We describe the spectrometer and experimental stations on the infra-red beamline (IR4) at the National Synchrotron Light Source, Brookhaven. We also report measurements of the source characteristics in the range 30–400 μ (25–350 cm^{-1}), including both flux and brightness and compare them with corresponding measurements from a 1000K black-body source. 10 refs., 3 figs.

3284 (BNL–43348) **Mechanical design of SXLS [Superconducting X-ray Lithography Source] radio-frequency cavity.** Mortazavi, P.; Sharma, S.; Keane, J.; Thomas, M. Brookhaven National Lab., Upton, NY (USA). [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890335–267: 13. particle accelerator conference, Chicago, IL (USA), 20-23 Mar 1989). Order Number DE90002289. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper presents the mechanical design of a Radio-Frequency (RF) cavity to be used on a compact storage ring for Superconducting X-ray Lithography Source (SXLS). Various design features of this cavity are discussed, including basic geometrical configuration, structural design, initial and operational tuning, vacuum multipactoring, power window, and damping of higher order modes. A second application of this cavity design for beam life extension in an existing storage ring is also described. 2 refs., 6 figs.

3285 (CONF-890906–6) **Comparison of photodesorption yields from aluminum stainless and Cu-plated beam tubes.** Halama, H.J.; Foerster, C.L. Brookhaven National Lab., Upton, NY (USA). 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. From 11. international vacuum congress and 7th international conference on solid surfaces; Cologne (Germany, F.R.); 25-29 Sep 1989. Order Number DE90002428. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Photon Stimulated Desorption (PSD) from the walls of beam ducts constitutes the most serious gas load in storage rings and therefore exerts a great influence on both beam quality and lifetime. With the exception of the SSC which plans to use a Cu-plated beam tube, all existing and proposed machines use either aluminum or stainless steel beam tubes. In order to develop techniques for producing surfaces with the lowest PSD, we have studied the above materials using a dedicated beam line at the National Synchrotron Light Source (NSLS). Three meter long tubes were exposed to white light beams having critical energy of 500 eV and the desorption yields were measured as a function of beam dose. Several treatments commonly used for cleaning surfaces (prebaked, baked, fired, chemically cleaned and dc glow discharged) were investigated, and their relative merits are discussed. The results from sample tube measurements are compared with those from the X-rya ring Al beam tube during operation. The agreement is found to be quite good. Glow discharge cleaned stainless steel exhibited the lowest desorption yield. 7 refs., 9 figs.

3286 (DOE/ER/40266–2) **Development of polarized ion beams and polarized gas targets: Final scientific report.** Anderson, L.W. Wisconsin Univ., Madison, WI (USA). Dept. of Physics. [1989]. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER40266. Order Number DE90002769. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This final scientific report for DOE Grant No. FG02-86ER40266 summarizes the research carried out with DOE support on the uses of optical pumping for producing polarized ion sources and targets for nuclear physics experiments. This report is broken up into two subsections. The first subsection is on the use of optical pumping in the production of polarized H^- ions, and the second subsection is on the use of optical pumping for polarized targets. 27 refs., 6 figs., 3 tabs.

3287 (FNAL-TM–1623) **Structural performance of the first SSC [Superconducting Super Collider] Design B dipole magnet.** Nicol, T.H. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890701–21: International cryogenic materials conference, Los Angeles, CA (USA), 24-28 Jul 1989). Order Number DE90003184. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The first Design B Superconducting Super Collider (SSC) dipole magnet has been successfully tested. This magnet was heavily instrumented with temperature and strain gage sensors in order to evaluate its adherence to design constraints and design calculations. The instrumentation and associated data acquisition system allowed monitoring of the magnet during cooldown, warmup, and quench testing. This paper will focus on the results obtained from structural measurements on the suspension system during normal and rapid cooldowns and during quench studies at full magnet current. 4 refs., 9 figs.

3288 (FNAL-TM–1626) **SSC [Superconducting Super Collider] supplementary conceptual design report: Cryogenics for detectors.** Fast, R.W. Fermi National Accelerator Lab., Batavia, IL (USA). 27 Sep 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE90003183. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This technical memorandum contains text provided to the SSC for their use in the Supplementary Conceptual Design Report. It was written as part of a Fermilab effort under the guidance of Ray Stefanski of the Fermilab Research Division. This particular memorandum considers the cryogenic systems required to support the superconducting magnets and liquid argon calorimeters associated with SSC detectors.

3289 (INIS-mf–12013, pp. 6-8) **The Heidelberg heavy ion postaccelerator.** Blum, M.; Brix, P.; Frauenfeld, M.; Friedrich, A.; Grieser, M.; Geyer, C.; Hahn, W.; Hemberger, K.H.; Holzer, B.; Horn, K. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear*

Physics. Annual report 1987. Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The Heidelberg Heavy Ion Postaccelerator has been operated in 1987 reliably in many beamtimes up to the summer shut down necessary to extend its high energy beam transport line by 30 m to set up the injection path for the TSR storage ring. A total of 5 new dipole magnets and 18 quadrupole lenses had to be incorporated. The complete transport system was operational again end of November allowing for a first beamtime at the crystal ball experiment. The completed injection beam line for the TSR made a first successful test with the storage ring injection components possible on December 19. (orig.).

3290 (INIS-mf–12013, pp. 27) **The source for polarized alkali ions.** Reich, H.; Baumann, P.; Butsch, R.; Giroux, J.; Jaensch, H.; Kober, G.; Leucker, H.; Mayer, R.; Moroz, Z.; Ott, W. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The source for polarized heavy ions (PSI) has been used to produce polarized beams of ^{6}Li and ^{23}Na. Reactions of ^{6}Li on ^{26}Mg at 44 MeV and ^{23}Na on ^{206}Pb at 170 MeV have been investigated. The method of polarizing an alkali atomic beam by optical pumping has been improved by using an electrooptic modulated laser beam. In accordance with the primary work of J. Kelly (Boulder, USA) and W. Ertmer (Bonn, FRG), a $LiTaO_3$ electrooptic modulator has been constructed and with this new equipment, the figure of merit of the source has been improved by a factor of 4. (orig.).

3291 (INIS-mf–12013, pp. 50) **Target preparation.** Baumann, H. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik); Essig, W.; Hirning, R.; Kayser, J.; Ferber, H.; Grabisch, K.; Shamir, M.; Schuehrer, B.; Wirth, H.L. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

About 650 targets from 22 different isotopes have been prepared in addition to 1200 stripper foils for the accelerators. (orig.).

3292 (INIS-mf–12013, pp. 51-52) **Preparation of isotopically pure ^{48}Ca-targets by ion implantation in C-foils.** Baumann, H. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik); Essig, W.; Hirning, R.; Kayser, J.; Ferber, H.; Grabisch, K.; Shamir, M.; Schuehrer, B.; Wirth, H.L. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

A method is described to use ion implantation for preparing ^{48}Ca-targets of highest isotopic purity from material with low isotopic enrichment into thin self-supported ^{12}C foils (30 μg/cm^2). (orig.).

3293 (INIS-mf–12013, pp. 108-111) **Ultracold ion beam.** Baumann, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Welti, K.; Zwickler, S.; Berger, J.; Krause, P.; Neumann, R.; Schwalm, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The motivation for building a photoemitted ultracold electron beam and first work aiming at its realisation are outlined. (orig.).

3294 (INIS-mf–12013, pp. 113-114) **Laser cooling.** Baumann, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Welti, K.; Zwickler, S.; Schroeder, S.; Kuehl, T.; Berger, J.; Krause, P.; Neumann, R.; Schwalm, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The preparations for laser cooling of ^{7}Li^{+} and ^{9}Be^{+} ions in the TSR are described. (orig.).

3295 (INIS-mf–12013, pp. 158) **Development of a laser ion source for xenon.** Wunderlich, R.; Schneider, K.; Kiko, J.; Kirsten, T. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

An ion source for xenon has been developed based on resonant laser ionization of xenon atoms. The source combines high sensitivity with chemical selectivity. The values for the sensitivity and selectivity obtained are 2.5×10^{-4} Amp/Torr and 40, respectively. The latter value is a lower limit. This ion source is now implemented into a time of flight mass spectrometer. (orig.).

3296 (INS–744) **Design of a large superconducting spectrometer magnet.** Shintomi, T.; Makida, Y.; Mito, T.; Yamanoi, Y.; Hashimito, O.; Nagae, T. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1989. 4p. Order Number DE90719505. Available from NTIS (US Sales Only), PC A02/MF A01.

The superconducting spectrometer magnet for nuclear physics experiments has been under construction by Institute for Nuclear Study, University of Tokyo with collaboration from KEK. The magnet has a sector type coil. The magnetic field is 3 T with the magnet gap of 50 cm and the stored energy is 11.8 MJ. The easy operation and maintenance are taken into consideration in addition to usual design concept. Three dimensional magnetic field calculation and the stress analysis have been performed. The code 'QUENCH' was applied to decide the operation current and to check the safety of the coil. As a result, the current of 500 A was selected. The heat leaks were checked and estimated less than 2 W at 4 K. A small refrigerator is to be used for thermal insulations at 80 and 20 K. (author).

3297 (LA–11662-MS) **Report from the workshop on computing directions and options for data acquisition and analysis at LAMPF [Los Alamos Meson Physics Facility].** Oothoudt, M.A.; Hoehn, M.V.; Amann, J.F.; Bemis, C.B.; Carey, T.A.; Cooper, P.S.; Cort, G.P.; Harrison, J.F.; Kinney, E.R.; Kozlowski, T.; Loken, S.C.; Louis, W.C.; Mischke, R.E.; Wouters, J.M. Los Alamos National Lab., NM (USA). Oct 1989. 40p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8901165–Summ.: Workshop on computing directions and options for data acquisition and analysis at LAMPF, Los Alamos, NM (USA), 11-13 Jan 1989). Order Number DE90001776. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A workshop met in January 1989 to review future requirements for computer support of the experimental program in medium energy physics at the Los Alamos Meson Physics Facility. The recommendations of the workshop are presented. 18 refs., 2 figs., 1 tab.

3298 (LA-UR–89-3397) **INEX [integrated numerical experiment] simulations of the Los Alamos HIBAF [high-brightness accelerator free-electron laser] free-electron laser MOPA [master oscillator power amplifier] experiment.** Goldstein, J.C.; Carlsten, B.E.; McVey, B.D. Los Alamos National Lab., NM (USA). 1989. 17p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-8908134–10: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90002387. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present results of Integrated Numerical Experiment (INEX) simulations of the performance of a 1-m untapered wiggler FEL oscillator driving a 2-m wiggler FEL amplifier for the new HIBAF (High-Brightness Accelerator Free-Electron Laser) facility at Los Alamos. INEX simulations utilize a numerically-generated electron micropulse, from ISIS/PARMELA calculations of the photoinjector/linac/beam transport system, in the 3-D FEL simulation code FELEX. 13 refs., 10 figs., 1 tab.

3299 (LBL–21520) **Ground motion measurements at the 1 - 2 GeV synchrotron radiation source site.** Green, M.A.; Majer, E.L.; More, V.D.; O'Connell, D.R.; Shilling, R.C. Lawrence Berkeley Lab., CA (USA). May 1986. 35p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90003046. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes the technique for measuring ground motion at the site of the 1–2 GeV Synchrotron Radiation Source (Light

Source) at Building 6. The results of ground motion measurements at the Light Source site are presented. As comparison, ground motion measurements were made at the Byerly Tunnel, the Bevatron, Blackberry Canyon, and SLAC at the Spear Ring. The primary ground motion at the Light Source site is in a band from 10 to 30 Hz. This noise is local in origin and is not easily transported through LBL soils. The background ground motion is for the most part less than 0.1 microns. Localized truck traffic near Building 6 and the operation of the cranes in the building can result in local ground motions of a micron or more for short periods of time. The background ground motion at Building 6 is between 1 and 2 orders of magnitude higher than ground motion in a quiet seismic tunnel. Ground motion at SLAC and the Bevatron is comparable to ground motions measured at the Building 6 Light Source site. The frequency signature of each site is very different. 8 refs., 20 figs., 1 tab.

3300 (LBL–26248) **An alternate end design for SSC dipoles.** Peters, C.; Caspi, S.; Taylor, C. Lawrence Berkeley Lab., CA (USA). Feb 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890270–24: International industrial symposium on the super collider, New Orleans, LA (USA), 8-10 Feb 1989). Order Number DE90003107. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Experience in the SSC dipole program has shown that fabrication of cylindrical coil ends is difficult. Cable stiffness requires large forces to maintain the proper position of the conductors in the end during winding. After winding, the coil ends remain distorted nd significant motion of the need conductors is required to force the coil end into the molding cavity. Local mechanical stresses are high during this process and extra pieces of insulation are required to prevent turn-to-turn shorts from developing during the winding and molding steps. Prior to assembly the coil end is compressed in a mold cavity and injected with a filler material to correct surface irregularities and fill voids in the end. LBL has developed an alternate design which permits the conductors to be wound over the end using minimal force and technician coerosion. The conductors are placed on a conical surface where the largest diameter over the outer layer conductors is 10 cm. No coil end spaces or insulation pieces between turns are required. The conductor geometry was analytically optimized to meet SSC multipole requirements for the ends. The first 1-m dipole utilizing this end geometry has been constructed and successfully tested. Design and construction data are presented. Also model test results, including training and multipole measurements of the end are given. 1 ref., 12 figs., 3 tabs.

3301 (LBL–26842) **Broad-beam multi-ampere metal ion source.** Brown, I.G.; Galvin, J.E.; MacGill, R.A.; Paoloni, F.J. Lawrence Berkeley Lab., CA (USA). Jun 1989. 9p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890703–25: International conference on ion sources, Berkeley, CA (USA), 10-14 Jul 1989). Order Number DE90003106. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An embodiment of the MEVVA (metal vapor vacuum arc) high current metal ion source has been developed in which the beam is formed from a 10-cm diameter set of extractor grids and which produces a peak beam current of up to several Amperes. The source, MEVVA V, operates in a pulsed mode with a pulse width at present 0.25 ms and a repetition rate of up to several tens of pulses per second (power supply limited). The multicathode feature that was developed for the prior source version, MEVVA IV, has been incorporated here also; one can switch between any of 18 separate cathodes and thus metallic beam species. Maximum beam extraction voltage is over 90 kV, and since the ion charge state typically from Q = 1 to 5, depending on the metal employed, the ion energy in the extracted beam can thus be up to several hundred keV. This source is a new addition to the MEVVA family of metal ion sources, and we are at present investigating the operational regimes and the limits to the source performance. In this paper we describe the source and present some preliminary results. 10 refs., 4 figs.

3302 (LBL–26843) **Charge state distribution studies of the metal vapor vacuum arc ion source.** Galvin, J.E.; Brown, I.G.; MacGill, R.A. Lawrence Berkeley Lab., CA (USA). Jun 1989. 12p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890703–27: International conference on ion sources, Berkeley, CA (USA), 10-14 Jul 1989). Order Number DE90003270. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have studied the charge state distribution of the ion beam produced by the MEVVA (metal vapor vacuum arc) high current metal ion source. Beams produced from a wide range of cathode materials have been examined and the charge state distributions have been measured as a function of many operational parameters. In this paper we review the charge state data we have accumulated, with particular emphasis on the time history of the distribution throughout the arc current pulse duration. We find that in general the spectra remain quite constant throughout most of the beam pulse, so long as the arc current is constant. There is an interesting early-time transient behavior when the arc is first initiated and the arc current is still rising, during which time the ion charge states produced are observed to be significantly higher than during the steady current region that follows. 12 refs., 5 figs.

3303 (LBL–26844) **Some novel design features of the LBL metal vapor vacuum arc ion sources.** MacGill, R.A.; Brown, I.G.; Galvin, J.E. Lawrence Berkeley Lab., CA (USA). Jun 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890703–26: International conference on ion sources, Berkeley, CA (USA), 10-14 Jul 1989). Order Number DE90003271. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The family of MEVVA (metal vapor vacuum arc) high current metal ion sources developed at LBL over the past several years has grown to include a number of different source versions with a wide range of some of the design and operational parameters. The MicroMEVVA source is a particularly compact version, about 2 cm diameter and 10 cm long, while the MEVVA IV weighs some 30 kG. MEVVAs IV and V incorporate multiple cathode assemblies (16 and 18 separate cathodes, respectively), and the operating cathode can be switched rapidly and without down-time. The new MEVVA V embodiment is quite compact considering its broad beam (10 cm), high voltage (100 kV) and multiple cathode features. The large-area extractor grids used in the MEVVA V were fabricated using a particularly simple technique, and they are clamped into position and so can be changed simply and quickly. The electrical system used to drive the arc is particularly simple and incorporates several attractive features. In this paper we review and describe a number of the mechanical and electrical design features that have been developed for these sources. 9 refs., 5 figs.

3304 (LBL–27339) **A high charge state multicusp ion source.** Leung, K.N.; Keller, R. Lawrence Berkeley Lab., CA (USA). Jun 1989. 15p. Sponsored by U.S. DOE Energy Research; Center for Heavy Ion Research (Gesellschaft fuer Schwerionenforschung Darmstadt - GSI Darmstadt); North Atlantic Treaty Organization. DOE Contract AC03-76SF00098. (CONF-890703–28: International conference on ion sources, Berkeley, CA (USA), 10-14 Jul 1989). Order Number DE90000126. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Attempts have been made to generate high charge state ion beams by employing a multicusp plasma source. Three experimental investigations have been performed at LBL and at GSI to study the charge state distributions and the emittance of the extracted beam. Results demonstrate that charge state as high as +7 can be obtained with argon or xenon plasmas. The brightness of a 11 mA xenon ion beam is found to be 26 $A/(\pi\text{-mm-mrad})^2$. 6 refs., 6 figs.

3305 (LBL–27421) **Operation of a DC large aperture volume-production H^- source.** Kwan, J.W.; Ackerman, G.D.; Anderson, O.A.; Chan, C.F.; Cooper, W.S.; deVries, G.J.; Leung, K.N.; Lietzke, A.F.; Steele, W.F. Lawrence Berkeley Lab., CA (USA). Apr 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890703–23: International conference on ion sources, Berkeley, CA (USA), 10-14 Jul 1989). Order Number DE90002668. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In testing a multicusp volume-production H^- ion source (20 cm diameter, 23 cm long), we optimized the gas pressure, the plasma electrode bias potential and the magnetic filter. At the optimum

pressure of 9 mT, the H^- beam output increased linearly with discharge power. The maximum H^- beam, measured with a current transformer downstream of the accelerator, was 100 mA while using a 6.67 cm^2 aperture. Presently we are limited by overheating of the cathodes by the plasma ions. Under similar discharge conditions the maximum H^- current density was found to vary as $a^{-0.7}$ where a is the aperture radius. Results from emittance measurements showed that the effective H^- ion temperature increased with a for $a > 0.8$ cm. Thus the brightness of the beam decreased with increasing aperture radius. Operating the source with cesium would increase the H^- output however our accelerator must be improved to avoid breakdowns caused by the cesium contamination. 8 refs., 6 figs.

3306 (LBL–27606) **ECR sources for the production of highly charged ions.** Lyneis, C.M.; Antaya, T.A. Lawrence Berkeley Lab., CA (USA). Sep 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890703–24: International conference on ion sources, Berkeley, CA (USA), 10-14 Jul 1989). Order Number DE90002670. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Electron Cyclotron Resonance Ion Sources (ECRIS) using RF between 5 and 16 GHz have been developed into stable, reliable sources of highly charged ions produced from a wide range of elements. These devices are currently used as ion sources for cyclotrons, synchrotrons, and heavy-ion linacs for nuclear and relativistic heavy-ion physics. They also serve the atomic physics community as a source of low energy multiply-charged ions. In order to improve their performance both with respect to maximum charge state and beam intensity, ECRIS builders are now designing and constructing sources which will operate at frequencies up to 30 GHz. In this paper we review the present status of operating ECRIS, review recent experimental measurements on plasma parameters, and look at the technology and potential of sources operating at frequencies up to 30 GHz. 14 refs., 4 figs., 1 tab.

3307 (LBL–27664) **Successful observation of Schottky signals at the Tevatron collider.** Goldberg, D.A.; Lambertson, G.R. Lawrence Berkeley Lab., CA (USA). Aug 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890803–35: International conference on high energy accelerators, Tsukuba (Japan), 20-26 Aug 1989). Order Number DE90002166. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We have constructed a Schottky detector for the Tevatron collider in the form of a high-Q (≈5000) cavity which operates at roughly 2 GHz, well above the frequency at which the Tevatron's single-bunch frequency spectrum begins to roll off. Initial spectra obtained from the detector show clearly observable Schottky betatron lines, free of coherent contaminants; also seen are the "common-mode" longitudinal signals due to the offset of the beam from the detector center. The latter signals indicate that at 2 GHz, the coherent single-bunch spectrum from the detector is reduced by >80 dB; therefore, in normal collider operation, the Schottky betatron lines are >40 dB greater than their coherent counterparts. We describe how the data we have obtained give information on transverse and longitudinal emittances, synchrotron frequency, and betatron tunes, as well as reveal what may be previously unobserved phenomena. Space limitations restrict us to presenting only as much data as should be necessary to convince even the skeptical reader of the validity of the claim made in the paper's title. 3 refs., 2 figs.

3308 (SAND–89-7106) **Single fluid simulations of plasma openings switch behavior.** Frese, M.H.; Payne, S.S.; Peterkin, R.E. Jr. Sandia National Labs., Albuquerque, NM (USA); Mission Research Corp., Albuquerque, NM (USA). Sep 1989. 119p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90002643. Available from NTIS, PC A06/MF A01 - OSTI.

The bulk of this report summarizes a study of plasma opening switch (POS) behavior using a two-dimensional single fluid code known as MACH2. This effort developed a model for the plasma motion during injection and the resultant mass distribution at the time of accelerator during that was consistent with the plasma diagnostic information obtained from experiments performed on the PBFA II accelerator at Sandia National Laboratories. The emphasis in this follow-on effort has been on developing a single fluid model of the switching process itself. The ability to model a POS in a reasonable manner with a single fluid code was first demonstrated with the two-dimensional HAM code. Subsequent studies of the operation of a POS that employ HAM and were performed during the last quarter of this research effort are also discussed in this report. Most of the MACH2 simulations discussed in this report were performed on Cray supercomputers at Los Alamos National Laboratory. During the course of this research effort, MACH2 was installed on the Sandia Cray computer. The HAM code already existed on the Sandia Cray and all HAM simulations took place on that computer. The model described here produced current histories qualitatively like those of the PBFA II experiments. In this model, the plasma gets pushed past the B-dot probes and into the walls and diode region, while the current sheet initially at the vacuum/plasma interface diffuses into the plasma due to the micro-turbulent resistivity. The anomalous collision frequency used in the MACH2 resistivity calculation is approximately 3 times the ion collision frequency. The conduction and switching times predicted by the model are determined by the initial density of the switch plasma; they are most consistent with experiments if the initial plasma is taken to be hydrogen between 1 and 3 $\times 10^{13}$ ions/cm^3 or carbon at a factor of 12 lower density.

3309 (SLAC-TN–89-1) **Finding the magnetic center of a quadrupole to high resolution: A draft proposal.** Fischer, G.E.; Cobb, J.K.; Jensen, D.R. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90002797. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In a companion proposal it is proposed to align quadrupoles of a transport line to within transverse tolerances of 5 to 10 micrometers. Such a proposal is meaningful only if the effective magnetic center of such lenses can in fact be repeatably located with respect to some external mechanical tooling to comparable accuracy. It is the purpose of this note to describe some new methods and procedures that will accomplish this aim. It will be shown that these methods are capable of yielding greater sensitivity than the more traditional methods used in the past. The notion of the "nodal" point is exploited. 4 refs., 5 figs., 1 tab.

3310 (SLAC-TN–89-2) **Final focus test beam alignment: A draft proposal.** Fischer, G.E.; Ruland, R.E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90002798. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Final Focus Test Beam is a transport line designed to transmit 50 GeV electron beams of SLC emittance (3×10^{-10} radian-meters) straight through the central arm of the Beam Switchyard (BSY C line) with a final focus point out in the Research Yard but relatively near the end of the switchyard tunnel. The hardware, methods and procedures outlined in this proposal are dedicated to measuring the placement of mechanical objects with respect to certain defined geometric axes. We wish to emphasize that the very difficult problems of locating the effective magnetic axes of focusing elements, the effective electrical center of beam position monitors and even the effective axis of the incident beam relative to mechanical reference surfaces is outside the scope of this work. Further, this proposal is restricted to the act of measurement and does not consider the vital task of on-line mechanical repositioning of elements that will, in likelihood, be called upon during operation of the system. 16 refs., 16 figs., 4 tabs.

3311 **Lithium beam measurements on PBFA II.** Ruiz, C.L. (Sandia National Labs., Albuquerque, NM (US)); Bieg, K.W.; Johnson, D.J.; Leeper, R.J.; Lockner, T.R.; Maenchen, J.; Mehlhorn, T.A.; Pregenzer, A.L.; Stygar, W.A.; Woodworth, J.R. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC04-76DP00789. (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2P31.

Recent experiments on PBFA II indicate that lithium ion beams are being produced with regularity. Evidence for the production of

energetic lithium ions is based on measurements employing Thomson Parabola analyzers, Cu(n,2n) activation, and other diagnostics. In this paper lithium ions beam data, based on Thomson parabola and activation measurements, are presented. Three types of ion sources are pursued. Corroborating results with other diagnostics are also discussed.

3312 **Applications of RF linacs to free-electron lasers and particle beams.** Jameson, R.A. (Los Alamos National Lab., NM (USA)). *Journal of Fusion Energy (USA),* 6(4): 329-335 (Dec 1987). (CONF-870457–: Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies, Pleasanton, CA (USA), 8-9 Apr 1987).

The applications of radio frequency linear accelerators to the electron beam pumping of free electron lasers and to the production of neutral particle beams are evaluated in relation to technology development for the Strategic Defense Initiative and to fusion reactor research. Beam dynamics and ion source requirements and developments are addressed. The design of an RF cavity and its performance and materials requirements are assessed.

3313 **Applications of induction linacs to free-electron lasers and particle beams.** Briggs, R.J. (Lawrence Livermore National Lab., CA (USA)). *Journal of Fusion Energy (USA),* 6(4): 337-343 (Dec 1987). (CONF-870457–: Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies, Pleasanton, CA (USA), 8-9 Apr 1987).

The applications of induction linacs to the electron beam pumping of free electron lasers and the production of particle beams are reviewed. Induction technology for high beam current production is described within the context of particle beam weapons and free electron laser research and development. Material and magnet research is reviewed along with beam dynamics, propagation, and steering. Component technology experimentation and development conducted at Lawrence Livermore are reviewed.

4304 Storage Rings

Refer also to citation(s) 2818, 3962

3314 (BNL–43347) **Vacuum system design for a superconducting x-ray lithography light source.** Schuchman, J.C. Brookhaven National Lab., Upton, NY (USA). [1989]. 16p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890906–5: 11. international vacuum congress and 7th international conference on solid surfaces, Cologne (Germany, F.R.), 25-29 Sep 1989). Order Number DE90002296. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A superconducting electron storage ring for x-ray lithography (SXLS) is to be built at Brookhaven National Laboratory (BNL). The goal is to design and construct a light source specifically dedicated to x-ray lithography production and which would be used as a prototype in a technology transfer to American industry. The machine will be built in two phases: Phase I, a low energy ring (200 MeV 500ma) using all room temperature magnets which will be used primarily for low energy injection studies. Phase II will be a full energy machine (690 MeV 500ma) where the room temperature 180° dipole magnets of Phase I will be replaced with superconducting magnets. The machine, with a racetrack shape and a circumference of 8.5 meters, is designed to be portable and replaceable as a single unit. This paper will discuss the vacuum system design for both phases; i.e., gas desorption, warm bore vs cold bore, ion trapping, clearing electrodes, and diagnostic instrumentation. It would seem that a compact light source, relatively small in size for an electron storage ring, would be simple to design and build. That is not the case, however, since all the problems that arise for a larger machine must be addressed. From a vacuum standpoint, gas desorption, pumping, chamber material and design, ion trapping, diagnostics, etc. must all be considered. However, for a small machine not as many parts have to be made. 6 figs., 1 tab.

3315 (BNL–43350) **Pretreatment and conditioning of storage ring vacuum systems.** Halama, H.J. Brookhaven National Lab., Upton, NY (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8904282–1: 22. annual American Vacuum Society Southern California symposium, Los Angeles, CA (USA), 3-7 Apr 1989). Order Number DE90002297. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The performance of a storage ring is measured in terms of beam lifetime, beam size, beam stability and recovery of normal operating pressure. In order to insure successful operation, one starts with the proper material selection, followed by the desired conditioning of all components before they are installed in the storage ring. Then the entire ring is leak-checked and thoroughly baked-out. After cooldown the average pressure in the ring reaches the 10^{-10} Torr range with hydrogen constituting more than 90% of residual gas. The final clean-up, known as beam commissioning, is done by the particle beam itself. In this paper a review and discussion of the following will be presented: chemical cleaning techniques for the most commonly used metals (aluminum, stainless steel and copper); RF and DC glow discharge treatments and their effect on both outgassing and photon stimulated desorption; reactive gas cleaning; RF cavity conditioning including multipactoring suppression; final bake-out; beam commissioning. 30 refs., 10 figs.

3316 (CONF-890826–5) **Crystalline beams.** Schiffer, J.P. Argonne National Lab., IL (USA). 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International nuclear physics conference; Sao Paulo (Brazil); 20-26 Aug 1989. Order Number DE90002174. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Ions in a storage ring are confined to a mean orbit by focusing elements. To a first approximation these may be described by a constant harmonic restoring force: $F = -Kr$. If the particles in the frame moving along with the beam have small random thermal energies, then they will occupy a cylindrical volume around the mean orbit and the focusing force will be balanced by that from the mutual repulsion of the particles. Inside the cylinder only residual two-particle interactions will play a significant role and some form of ordering might be expected to take place. The results of some of the first MD calculations showed a surprising result: not only were the particles arranged in the form of a tube, but they formed well-defined layers: concentric shells, with the particles in each shell arranged in a hexagonal lattice that is characteristic of two-dimensional Coulomb systems. This paper discusses the condense layer structure.

3317 (CONF-8904281–1) **Quadrupole magnet for the APS [Advanced Photon Source] storage ring.** Thompson, K.M.; Kim, S.H.; Lari, R.J.; Turner, L.R. Argonne National Lab., IL (USA). [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Particle accelerator conference; Chicago, IL (USA); 20-23 Apr 1989. Order Number DE90002255. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An asymmetric core geometry has been selected for the quadrupole magnets in the storage ring of the Advanced Photon Source (APS) in order to accommodate the vacuum chamber and photon beam pipes. The requirements of the position beam make it necessary that the magnet be able to produce a field gradient of 20-T/m with high accuracy. The design for this magnet has been fully developed in preparation for the construction of a prototype. Some unique features included in the design are described. Design choices are being validated by extensive magnetic-field calculations in both two and three dimensions. The results of these calculations are presented. 6 refs., 4 figs., 5 tabs.

3318 (CONF-8908170–2) **Overview of the advanced photon source.** Moncton, D.E.; Crosbie, E.; Shenoy, G.K. Argonne National Lab., IL (USA). May 1989. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 3. international conference on synchrotron radiation instrumentation; Tsukuba (Japan); 29 Aug - 2 sep 1989. Order Number DE90002179. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Advanced Photon Source planned for construction at Argonne National Laboratory is based on a low-emittance storage-ring operated at 7 GeV and capable of providing tunable undulator radiation from 4 to 40 keV (using the first and the third harmonics). A technical description of the accelerator facility and the storage-ring is presented in this overview, along with a brief summary of the characteristics of radiation that will be available from the insertion

devices. Various plans for user access to this national user facility are also given. 8 refs., 2 figs.

3319 (DOE/ER/40224–86) **Theory of elementary particles studies in weak interaction and grand unification and studies in accelerator design: Annual report, Task B.** Csonka, P.L. Oregon Univ., Eugene, OR (USA). [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. Order Number DE90003325. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

During the past year the investigation of micropole undulators continued. These devices were proposed as a means of extending the range of useful photon energies emerging from high energy electron storage rings, as well as devices capable of reducing the size, expense and circulating electron energy required to generate radiated photons of a given wavelength. Various applications of these devices were studied, and the conditions under which alternative types of micropole devices can be employed in storage rings of given characteristics, were explored. During the year covered by this report of activities a patent on micropole undulators was obtained.

3320 (GAO/RCED–89-18) **Federal research: Determination of the best qualified sites for DOE's super collider.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 68p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

In January 1987 the administration proposed to construct the world's largest high-energy physics accelerator, known as the superconducting super collider, to advance scientific knowledge about the fundamental components of matter and the laws that underlie all physical processes. In April 1987 the Department of Energy issued an invitation for site proposals. In selecting the best qualified sites, Energy received technical assistance from the National Academy of Sciences and the National Academy of Engineering, which jointly formed a site evaluation committee. Available documentation and interviews with committee members and staff indicated that it used Energy's site selection criteria in their order of importance and that the process was fair in selecting the Dallas-Ft. Worth, Texas, as the preferred site. This process is discussed in this paper.

3321 (INIS-mf–12013, pp. 8-26) **The Heidelberg heavy ion test storage ring.** Arnold, W. (Giessen Univ. (Germany, F.R.)); Drdlicik-Lex, E.; Hielscher, D.G.; Matl, K.; Neumann, R.; Noda, A.; Pierce, P.; Thivent, M.; Trincat, B.; Schuch, R. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

In the time of the report it was possible to finish a large part of the construction work at the Heidelberg test storage ring. Important interim steps were among others: - Field measurement of the eight dipole magnets - measurement of the twenty quadrupole lenses - calibration of the 28 main magnets - manufacture and installation of the twelve sextupole magnets - finishing of the cabling - delivery and taking into operation of the power supplies - installation of the injection components - construction of the vacuum system in sector 1 - finishing of the transfer line between postaccelerator and TSR. These activities culminated in a first beam test at December 19, 1987 in which a 65 MeV C^{5+} plus beam was injected by the injection components into the ring and measured after deviation by 90^0 at the end of the sector 1 in a Faraday cup. The test required that all magnet systems of the ring worked. Without larger problems it succeeded to guide the beam with 100% transmission by the septa into the TSR and to transport around 1/4 of the ring periphery. (orig.).

3322 (INIS-mf–12013, pp. 36-37) **Filter target experiment (FILTEX).** Korsch, W. (Marburg Univ. (Germany, F.R.). Fachbereich 13 - Physik); Luck, W.; Giroux, J.; Graw, G.; Schiemenz, P.; Pohlenz, D.; Jaensch, H.; Kober, G.; Steffens, E.; Vogt, H. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

This experiment has been proposed in order to polarize antiprotons circulating in a storage ring by means of an internal polarized hydrogen target and to measure spin-dependent observables in panti p interaction. A dense H target for the proton test experiment prepared for the TSR is being constructed. The status of the target is described. (orig.).

3323 (JAERI-M–89-066) **Undulator sources at a 8 GeV storage ring.** Harami, Taikan. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 45p. Order Number DE90719531. Available from NTIS (US Sales Only), PC A03/MF A01.

The use of undulators plays an important role as a high brilliance sources of synchrotron photon at a facility having an electron (or positron) storage ring. This paper describes the characteristics, tunability from gap variation and brilliance of synchrotron photon from undulators at a 8 GeV storage ring. The numerical studies show the following results. (1) Undulators for a 8 GeV storage ring can cover the first harmonic photon energy range from about 0.3 to 30 keV and the third harmonic photon from 0.85 to 70 keV. (2) The brilliance of undulator can be expected to be the order of 10^{21} photons/(sec mm^2 $mrad^2$ 0.1% band width mA), without size and angular spread in the electron beam (diffraction limit). (3) The peak brilliance has a broad maximum as a function of β function of the lattice and is shown to be practically independent on the β function. The peak brilliance is calculated to be the order of 10^{16} photons/(sec mm^2 $mrad^2$ 0.1% band width mA) at the electron beam emittance of 5×10^{-9} mcenter dotrad (undulator length 2 m). (4) The nuclei of ^{57}Fe, ^{119}Sn and ^{238}U are expected to be the candidates for the Moessbauer scattering experiment using synchrotron photon from a 8 GeV storage ring. (author).

3324 (JAERI-M–89-079) **Flux and power spectra of photon sources from bending magnets and insertion devices at a 8 GeV storage ring.** Harami, Taikan. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 43p. Order Number DE90719538. Available from NTIS (US Sales Only), PC A03/MF A01.

The synchrotron photon from bending magnets and insertion devices (undulator and wiggler) plays an important role not only for scientific research but also for heat generation on the optical devices in a beam line for a high brilliant synchrotron photon facility. This paper describes the flux and power spectra of the synchrotron photon from bending magnets and insertion devices in a 8 GeV storage ring (electron beam current of 100 mA). The numerical studies show the following results. (1) The peak power density from a bending magnet is 1.33 kW/$mrad^2$ in the horizontal plane. The storage ring having 96 dipoles radiates the total power of 835 kW. (2) The energy shifter increases the critical energy to 127.7 keV at the magnetic field of 3 tesla. (3) The multipole wiggler can yield the maximum photon flux of 1.5×10^{15} photons/sec 0.1% band width. The total radiated power from a wiggler with the peak magnetic field of 1.0 tesla and the length of 4 m is 16.2 kW. The peak power density is 178 kW/$mrad^2$ in the forward direction. (4) The undulator with the length of 2 m and the peak magnetic field of 0.4 tesla yields the total power of 1.3 kW. The power density in the forward direction is expected to be between 100 $\sim$ 200 kW/$mrad^2$, depending on the undulator period and gap. (author).

3325 (JYFL-RR–1/1987) **Beam dynamical studies of cryring. Quarterly report 3. quarter 1987.** Heikkinen, Pauli. Jyvaeskylae Univ. (Finland). Dept. of Physics. Sep 1987. 89p. Order Number DE90608638. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

This thesis consits of two parts. Part 1 (Introduction to Accelerator Physics) gives the basis of understanding the formalism and parameters that are used in accelerator physics, especially in synchrotron theory. As an appendix of part 1 there is a short introduction to electron cooling which appears in the latter part of the thesis. Part 2 (Beam Dynamical Studies of CRYRING - Lattice Design Criteria and Operation Limits) was originally written and the work was done at the Research Institute of Physics in Stockholm as a part of the CRYRING project. Later, after some modifications in the lattice, the text was updated and some electron cooling simulation calculations with intrabeam scattering were done at the Department of Physics, University of Jyvaeskylae. CRYRING is a small acceletarot and storage ring for heavy ions and it will replace the old classical 225 cm cyclotron. CRYRING will mostly be used for atomic and molecular physics but nuclear physics will not be totally forgotten. Atomic physics, which will be done inside of the ring, requires the best beam quality. Good quality in this context means

small energy spread and small beam size and divergence (transverse velocity). The beam quality will be increased by using electron cooling. Nevertheless, increasing beam quality brings along some unwanted effects. If energy spread is decreased too much the beam will get ino some instabilities - the most important of them here is the microwave instability. There are some competing processes to cooling. They attempt to increase the energy spread and the emittance (divergence) of the beam. There processes are residual gas scattering and intrabeam scattering. Due to very strict vaccuum requirements residual gas scattering will be more or less harmless as emittance growth is concerned whereas intrabeam scattering will set the limi for beam quality where one parameter is the beam intensity. (Abstract Truncated)

3326 **Federal research: Determination of the best qualified sites for DOE's super collider.** 423p. US General Accounting Office, Gaithersburg, MD (1987).

In January 1987 the administration proposed to construct the world's largest high-energy physics accelerator, known as the superconducting super collider, to advance scientific knowledge about the fundamental components of matter and the laws that underlie all physical processes. In April 1987 the Department of Energy issued an invitation for site proposals that described the criteria and process for selecting the site. In selecting the best qualified sites, Energy received technical assistance from the National Academy of Sciences and the National Academy of Engineering, which jointly formed a site evaluation committee. Available documentation and interviews with committee members and staff indicate that it used Energy's site selection criteria in their order of importance and that the process was fair in selecting the Dallas-Ft. Worth, Texas, as the preferred site.

3327 **Random errors in the magnetic field coefficients of superconducting quadrupole magnets.** Herrera, J. (Brookhaven Nat. Lab., Upton, NY (US)); Hogue, R.; Prodell, A.; Thompson, P.; Wanderer, P.; Willen, E. pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). (CONF-870302–: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

The authors have studied the random errors in the multipole coefficients of superconducting dipole magnets that result from asymmetries in their construction. In this paper they consider, in a similar way, the random multipole errors of superconducting quadrupoles. Perfect symmetry of construction in such a magnet allows only higher normal multipoles of 12 pole, 20 pole, etc. to be present in the magnetic field. However, when the conductors are not perfectly positioned, this ideal symmetry is broken and the nonallowed multipoles, normal and skew, appear in the magnetic field. In analyzing the multipoles which arise due to random variations in the sizes and locations of the current blocks, the authors adopt a model analogous to that used for their analysis of the superconducting dipole.

44 INSTRUMENTATION

4401 Radiation Instrumentation

Refer also to citation(s) 2440, 3212, 3260, 3288, 3307, 3482, 3614, 3949, 3954, 3956, 3960, 4065, 4191, 4227, 4421

3328 (AD-A–210282/0/XAB) **Effects of normal annealing cycles during IGFET fabrication on initial and radiation-induced gate-insulator defects. Annual progress report, 1 December 1988-7 July 1989.** Walters, M.; Reisman, A. Microelectronics Center of North Carolina, Research Triangle Park, NC (USA). 13 Jul 1989. 14p. (TR–2). Available from NTIS, PC A03/MF A01.

The influence of three typical annealing cycles normally used in IGFET processing on as-fabricated and post-irradiated gate oxide defect levels was studied. These cycles were: (1) post-oxidation for 5 minutes at 1000 C in argon, (2) post-polysilicon for 30 minutes at 500 C in forming gas, and (3) post-metallization for 30 minutes at 400 C in hydrogen. Gate oxide defects were characterized using optically assisted electron injection of n-channel polysilicon-gated IGFET devices. It was found that the presence or absence of any of the three annealing cycles during the processing had no effect on measured interface state and bulk oxide defect levels in the as-fabricated devices. Following exposure to Al K (alpha) X-ray radiation, the increase in the number of bulk oxide defects was found to be independent also of the presence or absence of any of the cycles. The interface state density was found to increase only slightly following irradiation, with the smallest increase occuring for devices which had received either the post-oxidation or the post-metal anneal. These results may indicate that other high temperature steps which are present in IGFET processing, as well as the use of different electrode materials than were employed in the earlier studies overshadow the effects of the three annealing cycles studied, and therefore, the entire processing sequence of IGFET fabrication must be considered in determining the factors which influence gate insulator defect levels and susceptibility to ionizing radiation.

3329 (AD-A–211248/0/XAB) **High-efficiency fast-neutron detector. Memorandum report.** August, R.A.; Phillips, G.W.; Cutchin, J.H. Naval Research Lab., Washington, DC (USA). 2 Aug 1989. 24p. (NRL-MR–6518). Available from NTIS, PC A03/MF A01.

This report researches a concept for a high-efficiency detector of fast neutrons (several MeV), using solid-state charged-particle detectors overlaid with thick disks (about mm) of ^{238}U. Experiments show a significant count rate in the mockup when exposed to a fast-neutron flux, but it appears insensitive to the slow/thermal neutron flux. Preliminary results indicate a system with an efficiency on the order of at least 5% could be developed.

3330 (DOE/ER/40224–87) **[Theory of elementary particle studies in weak interaction and grand unification and studies in accelerator design]: Annual progress report.** Oregon Univ., Eugene, OR (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. Order Number DE90003324. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses: SLD detector; superconducting super collider; SICAPO; tau-charm factory proposal; beamstrahlung; Mark II small angle monitors; and Mark II data analysis. (LSP)

3331 (DOE/ER/40224–129) **Silicon calorimetry for the SSC[Superconducting Supercollider].** Bertrand, C.; Borchi, E.; Brau, J.E.; Bruzzi, M.; Bugg, W.M.; Furuno, K.; Lamarche, F.; Leroy, C.; Lindstroem, G.; Mazzoni, S.; Ohsugi, T.; Rancoita, P.G.; Russ, J.; Vismara, L. Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science. 8 Sep 1989. 43p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. (CONF-890379–16: Workshop on calorimetry for the SSC, Tuscaloosa, AL (USA), 13-17 Mar 1989). Order Number DE90003331. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

SSC experiments will rely heavily on their calorimeters. Silicon calorimetry, which has been introduced in recent years as a useful technology, has many attractive characteristics which may make it a viable option for consideration. The many attractive properties of silicon detectors are reviewed. The relevant present day applications of large areas of silicon detectors are summarize to illustrate the emerging use. The troublesome issue of radiation damage in a high luminosity environment like the SSC is considered with a summary of much of the recent new measurements which help clarify this situation. A discussion of the electronics and a possible mechanical configuration is presented, followed by a summary of the outstanding R and D issues. 31 refs., 11 figs., 3 tabs.

3332 (DOE/ER/40389–57) **The low energy frontier in high energy particle physics.** Martoff, C.J. Temple Univ., Philadelphia, PA (USA). Dept. of Physics. [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40389. (CONF-8905187–5: WEIN '89: international symposium on weak and electromagnetic interactions in nuclei, Montreal (Canada), 15-19 May 1989). Order Number DE90002567. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A number of interesting particle physics experiments can be performed if one can accurately measure KeV recoil atoms from certain low-energy scattering processes in massive active target/ detectors. The physics and experimental requirements of these experiments are discussed. The requirements of energy threshold

below 1 KeV and energy resolution of some tens of eV are difficult to achieve with conventional detectors. A proposed cryogenic particle detector technique is described, based on detection of quasiparticles in superconducting metal absorbers, and its theoretical noise characteristics computed. An experimental program is underway to develop the superconducting quasiparticle spectrometer detectors, and to measure ionization energy loss of KeV recoil atoms in solids. 33 refs., 2 figs.

3333 (FNAL-TM–1620) **Conceptual design report for a superconducting coil suitable for use in the large solenoid detector at the SSC [Superconducting Super Collider].** Fast, R.W.; Grimson, J.H.; Krebs, H.J.; Kephart, R.D.; Theriot, D.; Wands, R.H. Fermi National Accelerator Lab., Batavia, IL (USA). 15 Sep 1989. 93p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE90001797. Available from NTIS, PC A05/MF A01; OSTI; INIS.

The conceptual design of a large superconducting solenoid suitable for a magnetic detector at the Superconducting Super Collider (SSC) was done at Fermilab. The magnet will provide a magnetic field of 1.7 T over a volume 8 m in diameter by 16 m long. The particle-physics calorimetry will be inside the field volume and so the coil will be bath cooled and cryostable; the vessels will be stainless steel. Predictability of performance and the ability to safely negotiate all probable failure modes, including a quench, are important items of the design philosophy. Our conceptual design of the magnet and calorimeter has convinced us that this magnet is a reasonable extrapolation of present technology and is therefore feasible. The principal difficulties anticipated are those associated with the very large physical dimensions and stored energy of the magnet. 5 figs.

3334 (INIS-BR–1685) **Computerized tomographic in nondestructive testing.** Lopes, R.T. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Posgraduacao de Engenharia. 1988. 156p. (In Portuguese). Order Number DE90608804. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The process of computerized tomography has been developed for medical imaging purposes using tomographs with X-ray, and little attertion has been given to others possibles applications of technique, because of its cost. As an alternative for the problem, we constructed a Tomographic System (STAC-1), using gamma-rays, for nonmedical applications. In this work we summarize the basic theory of reconstructing images using computerized tomography and we describe the considerations leading to the development of the experimental system. The method of reconstruction image implanted in the system is the filtered backprojection or convolution, with a digital filters system to carried on a pre-filtering in the projections. The experimental system is described, with details of control and the data processing. An alternative and a complementary system, using film as a detector is shown in preliminary form . This thesis discuss and shows the theorical and practical aspects, considered in the construction of the STAC-1, and also its limitations and apllications.

3335 (INIS-BR–1748) **Performance of special extremity dosemeters of BeO in fields of x and gamma radiation.** Caldas, L.V.E.; Graf, W.; Brand, H.-N. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. 1p. (In Portuguese). (CONF-8908184–: 3. Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). Order Number DE90608788. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. THERMOLUMINESCENT DOSEMETERS/beryllium oxides; THERMOLUMINESCENT DOSEMETERS/gamma radiation; THERMOLUMINESCENT DOSEMETERS/x radiation

3336 (INIS-BR–1749) **Conection factors for clinical dosemeters used in dosimetry of large fields radiation.** Campos, L.L.; Caldas, L.V.E. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. 1p. (In Portuguese). (CONF-8908184–: 3. Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). Order Number DE90608789. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. IONIZATION CHAMBERS/cables; IONIZATION CHAMBERS/connectors; IONIZATION CHAMBERS/radiation effects; CABLES; CONNECTORS; PERFORMANCE

3337 (INIS-BR–1750) **Angular dependence of parallels plates ionization chambers for x radiation.** Albuquerque, M. da P.P. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. 1p. (In Portuguese). (CONF-8908184–: 3. Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). Order Number DE90608812. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. IONIZATION CHAMBERS/incidence angle; IONIZATION CHAMBERS/x radiation

3338 (INIS-mf–12013, pp. 28-29) **Developments at the Q3D spectrograph.** Kruechten, B. v.; Rech, M.; Rychel, D.; Schuermann, B.; Schwan, A.; Speer, J.; Toews, H.; Wiedner, C.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

In 1987 the Q3D spectrograph was used for spectroscopy with α-particles. A position sensitive parallel plate detector was successfully commissioned. Wide pitch (8.5 mm) Si-strip detectors have been employed and their deterioration with the dose of different heavy ions has been investigated. For RBS-studies an array of Si-strip detectors with 100 μm pitch and 25 cm length is planned. First trials with a 3 MeV $^4He^+$ beam yielded a system resolution - accelerator and spectrograph - of 1.1 keV (FWHM). (orig.).

3339 (INIS-mf–12013, pp. 29-31) **Development of a 4π-detector system to be used at the SIS/ESR accelerator of the GSI/Darmstadt.** Pelte, D. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Trzaska, M.; Wessels, J.; Winkler, U.; Wolfenstaetter, H. 4pi Collaboration. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

An essential part of the 4π-detection system for the new SIS/ESR accelerator consists of the central drift chamber which will detect mainly protons and pions with multiplicities m<100. Monte Carlo models are developed to study the track distribution in the chamber and possible methods of track reconstruction. The construction of a small-size test chamber and the data readout system has been started. (orig.).

3340 (INIS-mf–12013, pp. 32-33) **SI ring counters for detection of evaporation residues.** Faschingbauer, U. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

An annular silicon strip detector (thickness 300 μm, inner diameter 4.6 cm, outer diameter 10 cm) designed to measure evaporation residues in the Heidelberg Crystal Ball was investigated with a Cf-252 source to examine energy resolution, cross-talk and a high counting rate with an economized electronic readout. A new feature is the detector's backsided readout. (orig.).

3341 (INIS-mf–12013, pp. 33-35) **Construction of a new 4π parallel plate detector for the Crystal Ball.** Klatt, C. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Schulz, E.; Habs, D.; Gerl, J.; Helmolt, U. v.; Korten, W.; Schwalm, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

A new generation of parallel-plate counters (PPZ) has been built. The spatial and time resolution was tested for two different cathode structures, namely a 'wedge and strip system' and a double cathode system. (orig.).

3342 (INIS-mf–12013, pp. 46) **Nuclear physics electronics.** Bulian, N.; Holoch, R.; Hornung, M.; Pelikan, P.; Roedel, R. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988.

(In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The main activities have been in the fields of development and fabrication of nuclear electronics. (orig.).

3343 (INIS-mf–12013, pp. 48-50) **Status of the data acquisition system for the Crystal Ball.** Ender, C. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Ludwig, W.; Maenner, R.; Bauer, P.; Becker, H.; Wurz, A.; Heyng, H.W. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The present status of the new data acquisition system for the Crystal Ball is discussed. (orig.).

3344 (INIS-mf–12013, pp. 79) **Investigation of monoenergetic pair conversion.** Kramp, J. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Schwalm, D.; Backe, H.; Habs, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

An experiment to measure the monoenergetic pair-conversion decay of fully stripped $^{59}Co(3^-/2)$ is being prepared. The solenoid transport system for positron detection was built up at the postaccelerator facility and optimized according to numerical simulations. (orig.).

3345 (INIS-mf–12013, pp. 104-107) **Collision-radiation recombination.** Baumann, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Welti, K.; Zwickler, S.; Berger, J.; Krause, P.; Neumann, R.; Schwalm, D.; Schuch, R.; Liesen, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The possibilities of investigating the electron-ion-recombination in the cooler-section of the TSR are discussed. The relevance of three-body collisional-radiative processes is pointed out. The proposed techniques to detect the charge changed ions and the X-rays from the radiative capture are described. (orig.).

3346 (INIS-mf–12013, pp. 122-124) **Development of an electron spectrometer for the HELIOS heavy ion experiment at CERN.** Breskin, A.; Chechik, R.; Drees, A.; Fischer, P.; Fraenkel, Z.; Glaessel, P.; Lamade, G.; Ries, H.; Sauvage, D.; Schoen, A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

For the readout of proportional chambers two new readout schemes have been developed, an optical readout and a pad readout. Both methods were tested at the UV detector of a RICH prototype detector in the electron beam of the CERN PS. High efficiency, good spatial resolution, and reliable operation of both schemes were found. (orig.).

3347 (INIS-mf–12013, pp. 134-138) **Gallium solar neutrino experiment (project 'GALLEX').** Burkert, E.; Breitenbach, M.; Doerflinger, D.; Hampel, W.; Heusser, G.; Kaether, D.; Kiko, J.; Kirsten, T.; Lenzing, A.; Moegel, P. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The GALLEX-Project for solar neutrino detection proceeds as planned. Particular milestones achieved in 1987 are: The construction of the 3-storey Process-Building. The construction of the 2-storey Counting-Building. The completion of the hall A-environemnt, all in the Gran Sasso Underground Laboratory in Assergi, Italy. The near completion of the galliumchloride production plant in Gramercy, Louisiana. The completion of the germanium-extraction pilot plant in KFK Karlsruhe. The optimalization of low level proportional counters. The verification of particularly low background rates in the preliminary Gran Sasso counting station. The realization of ^{50}Cr enrichment for use in the ^{51}Cr-source experiment performance test. (orig.).

3348 (INIS-mf–12013, pp. 142) **CoMA, an instrument for the detailed in-situ analysis of collected cometary particulates.** Kissel, J.; Fechtig, H.; Jessberger, E.K.; Krueger, F.R.; Niemczyk, N.; Schaefer, G.; Zscheeg, H. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The proposal for CoMA, a pulsed time-of-flight SIMS instrument to be flown onboard CRAF to rendezvous with a comet, had been accepted by NASA in October 1986. After several attempts it seems that funding by BMFT for the instrument pre-development phase can be obtained. Apart from that we made first essential progress in producing the primary ion pulses from an indium liquid metal ion source. Those pulses are needed to operate CoMA. (orig.).

3349 (INIS-mf–12013, pp. 142-143) **Analysis of surface composition of a Martian moon with the instrument LIMA-D onboard the Mars mission PHOBOS.** Kissel, J.; Jessberger, E.K.; Krueger, F.R.; Niemczyk, N.; Schaefer, G.; Vollmer, E. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

First results obtained with the MPI supported laboratory setup of a long distance time-of-flight mass-spectrometer confirm the applicability of the method to use laser-ionisation for remote analysis of small celestial bodies. After ratification of the treaty on Soviet-German cooperation in science, a grant by the BMFT enables us to participate in the LIMA-D flight instrument. We have now improved the operating system for the instrument and the data collection algorithm. In the laboratory we set up a unit to check the response of a multiplier system to complex input currents as they occur e.g. in the case of a mass spectrum. As laser-ionisation is a highly nonlinear process, where ion yields depend on a lot of parameters, an extensive laboratory study, in which we cooperate with colleagues from IKI in Moscow, FMI in Helsinki, and the University of Kaiserslautern, shall give actual ion yields and ion energies for the range of laser and focus conditions used in the PHOBOS flyby configuration. These data shall be available when the flyby takes place in December 1989. (orig.).

3350 (INIS-mf–12013, pp. 156-158) **Technical and methodical developments.** Arnold, F.; Fabian, R.; Helleis, F.; Hoffmann, J.; Knop, G.; Krieger, A.; Moehler, O.; Mueckler, P.; Pfeilsticker, K.; Preissler, B. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The laboratory studies focus on technical improvements of the new balloon-borne ACIMS (active chemical ionization mass spectrometry) -probe and basic investigations on the ACIMS method. In addition, the construction of a triple quadrupole mass spectrometer for ion fragmentation studies was started. (orig.).

3351 (INIS-mf–12013, pp. 158-159) **Energy calibration and quantitative analysis with ESCA.** Bednar, F.; Jessberger, E.K. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The installation of an ESCA (Electron Spectroscopy for Chemical Analysis) apparatus for studies complimentary to our SIMS analyses was continued. The energy-calibration of the ESCA-spectrometer disclosed problems in the stability of the analyzer sweep voltage which were solved by connecting the digital-analog-converter to the same ground potential as the ESCA-electronics. Afterwards calibration was performed using a copper and a gold target. The analysis of two more complex samples confirmed the accuracy of the calibration. The precision of the energy-scale is better than +-0.2 eV. (orig.).

3352 (INIS-mf-12013, pp. 159) **Calculations on a third order energy focusing time-of-flight mass spectrometer.** Vollmer, E.; Kissel, J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

In time-of-flight mass spectrometry the mass resolution can be improved by the use of energy focusing electric fields. Calculations on the design of a third order energy focusing instrument have been performed. (orig.).

3353 (LA–11702-MS) **A computer study of source-detector geometries proposed for the induced-emission tomography of transuranic elements.** Estep, R.J. Los Alamos National Lab., NM (USA). Nov 1989. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90002830. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We describe two unusual source-detector geometries that are proposed for the tomographic imaging of transuranic elements using beam interrogation. Both geometries demonstrate a high inherent imaging power. A proposed bremsstrahlung beam imaging method proves to be feasible for imaging the important uranium isotopes. Open geometry imaging methods, which use uncollimated detectors, require high-quality data to produce faithful images. 15 refs., 14 figs., 5 tabs.

3354 (LBL–27813) **Improved charge collection of the buried p-i-n a-Si:H radiation detectors.** Fujieda, I.; Cho, G.; Conti, M.; Drewery, J.; Kaplan, S.N.; Perez-Mendez, V.; Qureshi, S.; Street, R.A. Lawrence Berkeley Lab., CA (USA). Sep 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-891087–10: IEEE nuclear science symposium and exhibits, San Francisco, CA (USA), 25-27 Oct 1989). Order Number DE90002669. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Charge collection in hydrogenated amorphous silicon (a-Si:H) radiation detectors is improved for high LET particle detection by adding thin intrinsic layers to the usual p-i-n structure. This buried p-i-n structure enables us to apply higher bias and the electric field is enhanced. When irradiated by 5.8 MeV α particles, the 5.7 μm thick buried p-i-n detector with bias 300V gives a signal size of 60,000 electrons, compared to about 20,000 electrons with the simple p-i-n detectors. The improved charge collection in the new structure is discussed. The capability of tailoring the field profile by doping a-Si:H opens a way to some interesting device structures. 17 refs., 7 figs.

3355 (N–89-18288, pp. 182-183) **In situ XRF and gamma ray spectrometer for Mars sample return mission.** Lo, I.Y. (Cornell Univ., Ithaca, NY (USA)); Trombka, J.I.; Evans, L.G.; Squyres, S.W. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

A combined in situ X-ray fluorescence (XRF) and passive gamma ray spectrometer instrument is proposed for the chemical elemental analysis of various Martian surfaces and samples. The combined instrument can be carried on board a rover. The passive gamma ray or the neutron excited gamma ray system would be used to determine the elemental composition of the Martian surface while the rover is in motion. The XRF system would be used to perform analysis either on the Martian surface or on collected samples when the rover is stationary. The latter function is important both in cataloging the collected samples and in the selection of samples to be returned to earth. For both systems, data accumulation time would be on the order of 30 minutes. No sample preparation would be necessary.

3356 (RCNP-P–105, pp. 103-109) **Measurement of (n,p) reactions using the spectrograph DUMAS and an apparatus for high resolution (n,p) experiments at intermediate energy.** Matsuoka, N. (Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Jul 1989. (In Japanese). In *Proceedings of the workshop on neutron scattering and neutron reactions.* Order Number DE90705941. Available from NTIS (US Sales Only), PC A06/MF A01.

A test experiment of (n,p) reactions was carried out at En$\simeq$63 MeV using the spectrograph DUMAS at RCNP. The experimental method and preliminary results are described. Examinations were made on the apparatus for high resolution (n,p) experiments at intermediate energy using the magnetic spectrograph. A possible method to produce a high resolution neutron beam is described mainly. (author).

3357 (SLAC-PUB–5066) **The digital data acquisition chain and the cosmic ray trigger system for the SLD Warm Iron Calorimeter.** Benvenuti, A.; Piemontese, L.; Calcaterra, A.; De Sangro, R.; De Simone, P.; Burrows, P.N.; Cartwright, S.L.; Gonzales, S.; Lath, A.; Schneekloth, U.; Williams, D.C.; Yamartino, J.M.; Bacchetta, N.; Bisello, D.; Castro, A.; Galvagni, S.; Loreti, M.; PescarStanford Linear Accelerator Center, Menlo Park, CA (USA). Aug 1989. 8p. Sponsored by U.S. DOE Energy Research; National Institute for Nuclear Physics, Italy (Istituto Nazionale di Fisica Nucleare - INFN). DOE Contract AC03-76SF00515;AC02-76ER03069;AC02-76ER00881. (CONF-8905194–6: 4. Pisa meeting on advanced detectors: frontier detectors from frontier physics, La Biodola (Italy), 21-26 May 1989). Order Number DE90000943. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The entire data-acquisition chain, from the custom-made front-end electronics to the Fastbus readout and data-reduction module, for the digital readout of the SLD limited streamer tube Warm Iron Calorimeter and Muon Identifier is described. Also described is a Fastbus Cosmic Logic Unit being developed to achieve the capability of reading cosmic ray events, also during the inter-crossing time, for apparatus monitoring and calibration purposes. 9 refs., 9 figs.

3358 **Electronically focused time-of-flight powder diffractometers at the Intense Pulsed Neutron Source.** Jorgensen, J.D. (Argonne National Lab., IL (USA)); Faber, J. Jr.; Carpenter, J.M.; Crawford, R.K.; Haumann, J.R.; Hitterman, R.L.; Kleb, R.; Ostrowski, G.E.; Rotella, F.J.; Worlton, T.G. *Journal of Applied Crystallography (Denmark),* 22(4): 321-333 (1 Aug 1989). DOE Contract W-31-109-ENG-38.

Two time-of-flight powder diffractometers have operated at the Intense Pulsed Neutron Source (IPNS) since August 1981. These instruments use dedicated microcomputers to focus time-of-flight events so that data from different detectors can be summed into a single histogram. Thus, large multidetector arrays can be employed at any scattering angle from 12 to 157^0. This design permits data to be collected over a uniquely wide range of d spacings, while maintaining high resolution and count rates. The performance of the two instruments is evaluated by analyzing data from a standard Al_2O_3 sample by the Rietveld method. These instruments provide the capability for moderate- to high-resolution measurements with the duration of a typical run being a few hours. (orig.).

3359 **Neutron range spectrometer.** Manglos, S.H. To Dept. of Energy, Washington, DC. USA Patent 4,837,442. 6 Jun 1989. Filed date 10 Mar 1988. USA Patent Application 7,166,581. Int. Cl. G01T 3/00. 6p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

In this patent a neutron range spectrometer and method for determining the neutron energy spectrum of a neutron emitting source are disclosed. Neutrons from the source are collimated along a collimation axis and a position sensitive neutron counter is disposed in the path of the collimated neutron beam. The counter determines positions along the collimation axis of interactions between the neutrons in the neutron beam and a neutron-absorbing material in the counter. From the interaction positions, a computer analyzes the data and determines the neutron energy spectrum of the neutron beam.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 2294

3360 (AD-A–210502/1/XAB) **High-energy-neutron irradiation effects in GaAs modulation-doped field effect transistors**

(MODFETs): Threshold voltage. Technical report. Krantz, R.J.; Bloss, W.L.; O'Loughlin, M.J. Aerospace Corp., El Segundo, CA (USA). Electronics Research Lab. 15 Jun 1989. 40p. (TR–0089(4925-07)-3). Available from NTIS, PC A03/MF A01.

The effects of high-energy neutrons of fluences approaching 1 x 10^{15} power per sq cm on MODFETs were studied. Neutron-induced threshold voltage shifts are described by application of a finite-temperature strong-inversion, depletion-layer, charge-control model. The results of this model show that the neutron-induced threshold voltage is a consequence of electron trapping the GaAs layer near the AlGaAs/GaAs interface. This allows a convenient parameterization of the neutron degradation by accounting for these trapped electrons as effective acceptors', defining an effective accetor introduction rate, and applying the charge control model to describe the threshold voltage. Our analysis shows that neutron degradation in these AlGaAs/GaAs heterostructures is dominated by the change in the depletion-layer charge and the shift in the Fermi level with neutron fluence. The dominant mechanisms are shown to depend on GaAs material parameters, only. The contribution due the AlGaAs layer carrier removal is <3% of the total threshold voltage shift.

3361 (N–89-28454) **Interplanetary particle environment. Proceedings of a conference.** Feynman, J.; Gabriel, S. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. 165p. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). Available from NTIS, PC A08/MF A01.

A workshop entitled the Interplanetary Charged Particle Environment was held at the Jet Propulsion Laboratory (JPL) on March 16 and 17, 1987. The purpose of the Workshop was to define the environment that will be seen by spacecraft operating in the 1990s. It focused on those particles that are involved in single event upset, latch-up, total dose and displacement damage in spacecraft microelectronic parts. Several problems specific to Magellan were also discussed because of the sensitivity of some electronic parts to single-event phenomena. Scientists and engineers representing over a dozen institutions took part in the meeting. The workshop consisted of two major activities, reviews of the current state of knowledge and the formation of working groups and the drafting of their reports.

3362 (N–89-28454, pp. 35-47) **The effects of high energy particles on planetary missions.** Robinson, P.A. Jr. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

Researchers review the background and motivation for the detailed study of the variability and uncertainty of the particle environment from a space systems planning perspective. The engineering concern raised by each environment is emphasized rather than the underlying physics of the magnetosphere or the sun. Missions now being planned span the short term range of one to three years to periods over ten years. Thus the engineering interest is beginning to stretch over periods of several solar cycles. Coincidentally, detailed measurements of the environment are now becoming available over that period of time. Both short term and long term environmental predictions are needed for proper mission planning. Short term predictions, perhaps based on solar indices, real time observations, or short term systematics, are very useful in near term planning – launches, EVAs (extravehicular activities), coordinated observations, and experiments which require the magnetosphere to be in a certain state. Long term predictions of both average and extreme conditions are essential to mission design. Engineering considerations are many times driven by the worst case environment. Knowledge of the average conditions and their variability allows trade-off studies to be made, implementation of designs which degrade gracefully under multi-stress environments.

4403 Miscellaneous Instruments

Refer also to citation(s) 2053, 2084, 2121, 2346, 2388, 2419, 2915, 3211, 3264, 3314, 3883, 3895, 4288

3363 (CEA-N–2607) **Electron beam diagnostics study.** Garganne, P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. Aug 1989. 38p. (In French). Order Number DE90721139. Available from NTIS (US Sales Only), PC A03/MF A01.

This paper summarizes the results of a study on beam diagnostics, using carbon wire scanners and optical transition radiation (DTR) monitors. The main consideration consists in the material selection, taking their thermal properties and their effect on the beam into account.

3364 (CONF-8602126–) **UC accelerator mass spectrometry 1: Proceedings.** Ericson, J.E.; Taylor, R.E. (eds.). Lawrence Livermore National Lab., CA (USA). 25 Aug 1989. 76p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. From Mass spectrometry conference; Irvine, CA (USA); 15 Feb 1986. Order Number DE90002222. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This paper is meant to explore potential new applications of accelerator mass spectrometry (AMS). The proceedings of the Third International Symposium on Accelerator Mass Spectrometry illustrate the growing applications in earth science, archaeology, geophysics, astrophysics, oceanography and nuclear physics. The application of AMS promises to open up new lines of investigation in other disciplines as new problems and materials are examined. The overall detection and milligram size of AMS ^{14}C samples offer specific advantages over conventional proportional gas counting (PGC) and liquid scintillation counting (LSC), although there are inherent limitations imposed by accuracy, age limits and costs. There are a number of problems in various disciplines that can be addressed using AMS technology.

3365 (CONF-8907113–13) **The current status of two-dimensional electrophoresis in germ cell mutation research.** Giometti, C.S. Argonne National Lab., IL (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 5. international conference on environmental mutagens; Cleveland, OH (USA); 10-15 Jul 1989. Order Number DE90002191. Available from NTIS, PC A02/MF A01 - OSTI.

Previous research demonstrated that isoelectric focusing followed by sodium dodecyl sulfate (SDS) polyacrylamide gel electrophoresis can be used to resolve hundreds of proteins from a single sample into a pattern of well-defined polypeptide spots. The possible application of this two-dimensional electrophoresis (2DE) technique to the detection of heritable mutations was recognized and demonstrated using mouse tissues. The studies demonstrated that actual implementation of 2DE for large genetic studies, however, required rigorous pattern reproducibility and methods of extracting numerical data from the patterns. The development of equipment for multiple parallel 2DE analyses and of computer software for the analysis of the resulting 2DE patterns during the 10 years since the first description of 2DE have provided the necessary tools for the application of 2DE to genetic studies. We are currently using inbred strains of mice to study the mutation detection capability of 2DE. The levels of sample and pattern reproducibility required for detection of significant changes in protein expression are being defined; the detection of mutations induced by different classes of mutagen (e.g., those causing large versus small alterations in DNA) is being assessed; and the population of proteins (and therefore genes) monitored by 2DE analysis is being characterized. 19 refs., 3 figs.

3366 (CONF-8910216–3) **Cavitation-controlled ultrasonic agitator.** Sheen, S.H.; Lawrence, W.P.; Raptis, A.C. Argonne National Lab., IL (USA). Oct 1989. 5p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Ultrasonics symposium; Montreal (Canada); 3 Oct 1989. Order Number DE90002773. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

High-intensity ultrasound generally produces nonlinear acoustic cavitation and streaming in liquids. The ultrasonic energy required to cause cavitation and streaming in a liquid depends on the physical properties of the liquid, e.g., surface tension, viscosity, and entrained gases. Both cavitation and streaming generate acoustic noise whose signatures may be used to distinguish the stage of agitation and thus allow the process to be controlled. An ultrasonic

agitator has been designed for application in a confined area with a high-temperature, high-pressure, and corrosive environment. Control of this agitator is based on the detection of noise levels and subharmonics produced during cavitation and streaming. Noise signatures of agitation in different liquids and in liquids with particles have been determined, and discussed. 6 refs., 6 figs.

3367 (N–89-17298, pp. 43-51) **Development of a high temperature thin film static strain gage.** Hulse, C.O. (Pratt and Whitney Aircraft, East Hartford, CT (USA)); Bailey, R.S.; Grant, H.P.; Przybyszewski, J.S. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objective is to develop a new thin film resistance strain gage system which will be suitable for use inside gas turbine engines on blades or vanes at temperatures up to 1250 K. These gages are to be capable of making strain measurements to plus or minus 2000 microstrain with total errors of no more than plus or minus 10 percent during a 50 hour period. In addition to survival and stability in this hostile environment, attaining a low temperature coefficient of resistance, of the order of 20 ppm/K or less, is an important goal. This requirement arises from the presently unavoidable uncertainties in the measurement of exact temperatures inside gas turbine engines for use in making corrections for apparent strain.

3368 (N–89-17298, pp. 53-75) **Elevated temperature strain gages.** Lei, J.F.; Shaarbaf, M.; Brittain, J.O. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The objective is to study the electrical resistance of materials that are potentially useful as resistance strain gages at 1000 C. A set of criteria were set and used to select strain gage candidate materials that are electrically stable and reproducible at all temperatures up to 1000 C. For the experimental phase of this research, the electrical resistance change with temperature of three groups of materials (solid solution alloys, transition metal carbides, and semiconductors) were studied with the intention of identifying materials with low temperature coefficient of resistance and low resistance drift rate at 1000 C. A preliminary study of the gage factor on one of the best candidate materials, B sub 4 C, was also undertaken. The results of these investigations are presented.

3369 (N–89-17298, pp. 77-79) **Progress on a PdCr wire strain gage.** Englund, D.R. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. Oct 1987. (NASA-CP–2493;E–3745;NAS–1.55:2493;CONF-8710466–: Workshop on turbine engine hot section technology, Cleveland, OH (USA), 20-21 Oct 1987). In *Turbine Engine Hot Section Technology, 1987.* Available from NTIS, PC A20/MF A01.

The principal activity under the HOST effort to improve the state of the art in high temperature static strain measurement has been a contract under which a palladium-chromium (PdCr) alloy was developed. The contract effort is continuing with the goal of developing a thin film high temperature static strain gage system. In addition to this effort, researchers contracted with Battelle-Columbus Laboratories to draw the PdCr allow into wire while researchers at Lewis worked to gain experience with this alloy as a wire strain gage.

3370 (PB–89-871198/XAB) **Semiconductor gas sensors. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 132p. Available from NTISPC N01/MF N01.

Supersedes PB–88-862651.

This bibliography contains citations concerning the utilization of semiconductor devices as gas detectors. Topics include performance and operating characteristics of specific devices, materials descriptions, design considerations, and applications in pollution detection. Fabrication techniques are also considered. (This updated bibliography contains 228 citations, 75 of which are new entries to the previous edition.)

3371 (PNL-SA–17257) **Combined capillary electrophoresis and electrospray ionization mass spectrometry.** Smith, R.D.; Loo, J.A.; Barinaga, C.J.; Edmonds, C.G.; Udseth, H.R. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8909252–1: 14. annual Japanese Society for Biomedical Mass Speculation meeting, Nagoya (Japan), 28-30 Sep 1989). Order Number DE90001903. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The special capabilities of the capillary electrophoresis electrospray ionization-mass spectrometer interface for the analysis of peptides and proteins with molecular weights extending to in excess of 100 kilodalton are demonstrated. The dynamic combinations of both capillary zone electrophoresis and capillary isotachophoresis with electrospray ionization are illustrated for mixtures of peptides and proteins. The potential extension of these methods for determination of the primary structure (sequence) of proteins using tandem mass spectrometry is shown to be facilitated by the high charge state of ions produced by the electrospray interface. The relevance of these results for advances in analytical biochemistry is discussed. 24 refs., 4 figs.

3372 (UCRL–53935) **Optically based potassium sensor.** Roe, J.N. Lawrence Livermore National Lab., CA (USA). Jul 1989. 139p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90001793. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

A new colorimetric assay was developed for potassium ions in neutral aqueous solution. The method is based on the change in optical absorbance of the hydrophobic indicator 7-(n-decyl)-2-methyl-4-(3′, 5′-dichlorophen-4′-one)- indonaphthl-l-ol (MEDPIN). Formation of a ternary complex between a valinomycin-K^+ pair, and the anionic form of MEDPIN in a lipophilic phase resulted in the appearance of a strong blue absorption band. Potassium selectivity was achieved by use of the ion selective ionophore, valinomycin. The intensity of the blue absorption band (between 600 and 650 nm) was dependent on aqueous cation concentration. The spectroscopic properties of MEDPIN and the MEDPIN/valinomycin/K^+ interaction were measured in various solvents, at varying MEDPIN concentration, valinomycin concentration, and at different pH values in the aqueous phase. The assay was used to develop a potassium sensitive fiberoptic sensor that would allow the measurement of potassium ion concentrations in human blood in vivo. The operating characteristics of the sensor were determined. 110 refs., 18 figs., 7 tabs.

3373 **Fiber-optic wavelength-division multiplexing and demultiplexing using volume holographic gratings.** Moslehi, B. (Physical Optics Corporation, 2545 West 237th Street, Suite B, Torrance, California 90505 (US)); Harvey, P.; Ng, J.; Jannson, T. *Optics Letters (USA),* 14(19): 1088-1090 (1 Oct 1989).

We present theoretical and experimental results of a novel fiber-optic wavelength-division multiplexing (WDM) design employing a broadband (>150-nm) dichromated gelatin volume holographic grating operating in a reflective Littrow configuration with on-axis optics, a single lens, and one fiber array. This configuration can achieve better than −1.5-dB insertion loss and −40-dB cross talk for a 6-channel system and −2.5-dB insertion loss and −20-dB cross talk for a 12-channel system with 15-nm channel spacing. For an experimental 4-channel WDM unit we measured better than −1.5-dB insertion loss for all channels and less than −32-dB cross talk. This design can provide cost and performance benefits for local area network communication applications.

3374 **Computer control of the tunnel barrier width for the scanning tunneling microscope.** Piner, R. (Purdue University, Department of Physics, West Lafayette, Indiana 47907 (US)); Reifenberger, R. *Review of Scientific Instruments (USA),* 60(10): 3123-3127 (Oct 1989).

The design of a computer system which directly controls tunnel barrier width in a scanning tunneling microscope (STM) is described. This capability allows STM scans to be performed at a speed which is automatically determined by the roughness of the

surface under study. The computer system is inexpensive and designed with readily available components for the VME bus.

3375 **Double rotor for solid-state NMR.** Samoson, A. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, 1 Cyclotron Road, Berkeley, California 94720 and Chemistry Department, University of California, Berkeley, California 94720 (US)); Pines, A. *Review of Scientific Instruments (USA),* 60(10): 3239-3241 (Oct 1989). DOE Contract AC03-76SF00098.

An NMR double-rotation probe providing for reorientation of a sample around two axes is described, and the key design features for low-friction motion are discussed. By means of double rotation, second-order broadening is averaged away, thus enhancing the resolution of spectra for quadrupole nuclei in solid-state NMR.

3376 **A simple implementation of a power supply for constant phototube current in light modulation spectroscopy.** Jellison, G.E. Jr. (Solid State Division, Oak Ridge National Laboratory, P.O. Box 2008, Building 2000, MS 6056, Oak Ridge, Tennessee 37831-6056 (US)); Modine, F.A. *Review of Scientific Instruments (USA),* 60(10): 3345-3346 (Oct 1989). DOE Contract AC05-84OR21400.

A simple implementation of a commercially available high-voltage power supply is described whereby the power supply can be used for voltage biasing of a photomultiplier tube operating either in a constant dynode voltage or in a constant output current mode. In the constant current mode, low frequency fluctuations in the current are suppressed without attenuation of a high frequency signal. Both the phototube output current and the dynode voltage can be set by external voltages in the range from −10 to +10 V, making computer control easy with standard digital-to-analog converters.

3377 **Use of a charge-coupled device camera for broadband coherent anti-Stokes Raman scattering measurements.** Rakestraw, D.J. (Sandia National Laboratories Combustion Research Facility, Livermore, California 94551 (US)); Lucht, R.P.; Dreier, T. *Applied Optics (USA),* 28(19): 4116-4120 (1 Oct 1989).

The use of an unintensified charge-coupled device (CCD) camera for the acquisition of broadband CARS signals is demonstrated. The CCD camera offers significant advantages compared to intensified, linear photodiode array (PDA) detectors that are generally used for broadband CARS measurements. These advantages include higher spectral resolution and improved instrument function, larger dynamic range, and a 2-D format.

4404 Well Logging Instrumentation

3378 (LA-UR–89-3498) **MCNP [Monte Carlo Neutron Photon] capabilities for nuclear well logging calculations.** Forster, R.A.; Little, R.C.; Briesmeister, J.F. Los Alamos National Lab., NM (USA). [1989]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891087–8: IEEE nuclear science symposium and exhibits, San Francisco, CA (USA), 25-27 Oct 1989). Order Number DE90002404. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Los Alamos Radiation Transport Code System (LARTCS) consists of state-of-the-art Monte Carlo and discrete ordinates transport codes and data libraries. The general-purpose continuous-energy Monte Carlo code MCNP (Monte Carlo Neutron Photon), part of the LARTCS, provides a computational predictive capability for many applications of interest to the nuclear well logging community. The generalized three-dimensional geometry of MCNP is well suited for borehole-tool models. SABRINA, another component of the LARTCS, is a graphics code that can be used to interactively create a complex MCNP geometry. Users can define many source and tally characteristics with standard MCNP features. The time-dependent capability of the code is essential when modeling pulsed sources. Problems with neutrons, photons, and electrons as either single particle or coupled particles can be calculated with MCNP. The physics of neutron and photon transport and interactions is modeled in detail using the latest available cross-section data. A rich collections of variance reduction features can greatly increase the efficiency of a calculation. MCNP is written in FORTRAN 77 and has been run on variety of computer systems from scientific workstations to supercomputers. The next production version of MCNP will include features such as continuous-energy electron transport and a multitasking option. Areas of ongoing research of interest to the well logging community include angle biasing, adaptive Monte Carlo, improved discrete ordinates capabilities, and discrete ordinates/Monte Carlo hybrid development. Los Alamos has requested approval by the Department of Energy to create a Radiation Transport Computational Facility under their User Facility Program to increase external interactions with industry, universities, and other government organizations. 21 refs.

45 EXPLOSIONS AND EXPLOSIVES

Refer also to citation(s) 4200

3379 (AD-A–210499/0/XAB) **Tracking performance evaluation. Final report, 1 December 1987-31 August 1988.** Mori, S.; Chang, K.C.; Chong, C.Y.; Spain, S. Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab. 7 Dec 1988. 76p. Available from NTIS, PC A05/MF A01.

This final report documents the research conducted at Advanced Decision Systems, sponsored by Lincoln Laboratory, Massachusetts Institute of Technology, under a project entitled, Discrimination Architecture Engineering Support, from 1 December 1987 to 31 August 1988. In this research, simple analytic models were developed for predicting performance of tracking systems in terms of track purity under given tracking environments, in particular, multilayer ballistic missile defense environments concerning tracking surveillance and object discrimination. The main result is a simple analytic model which relates single-scan track-to-measurement association (correlation) performance to two key parameters, object density on sensors' focal planes, and average measurement prediction accuracy by tracks. Predicted track purity is then calculated, through this model, based on given object trajectories and sensor deployment patterns. Extended models were developed to account for false alarms and merged measurements (CSOs) due to limited sensor resolution. Small-scaled but fairly extensive Monte Carlo simulations support the analytic models for predicting track purity developed through this project.

4501 Chemical

Refer also to citation(s) 2260, 3106, 3468

3380 (MLM–3612(OP)) **Simultaneous thermal analysis techniques for characterization of energetic materials.** Whitaker, R.B.; Brown, C.R.; Chang, Cherng; McDaniel, J.A.; Tackett, J.R. EG and G Mound Applied Technologies, Miamisburg, OH (USA). [1989]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-8910157–3: American Defense Preparedness Association's (ADPA) international joint symposium on compatibility of plastics and other materials with explosives, propellants and pyrotechnics, and processing propellants, explosives, and ingredients, Vir Order Number DE90003028. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Simultaneous thermal analysis techniques for characterization of materials has become widespread, with increased availability of instrumentation for such analyses. EG&G Mound has the capability to do simultaneous thermogravimetry/differential scanning calorimetry (TG/DSC) to 825°C, simultaneous thermogravimetry/mass spectrometry (TG/MS) to 1000°C, and high temperature thermogravimetry/differential thermal analysis (TG/DTA) to 2400°C. Advantages of these simultaneous techniques include the exact correlation of TG weight loss data with observed enthalpic transitions and with evolved gas analysis. These thermal analysis techniques have proven to be very useful in the characterization and study of reactions of energetic materials. In this study, several secondary explosives have been examined by TG/DSC to determine weight losses during melting and decomposition, and by TG/MS to identify the decomposition products. Reactions of two pyrotechnic blends were studied by TG/DTA under varying analysis conditions. 5 refs., 3 figs., 3 tabs.

3381 (SAND–89-1437C) **Fast transit gas- and condensed-phase chemistry of energetic materials.** Skocypec, R.D.;

Erickson, K.L.; Renlund, A.M.; Trott, W.M. Sandia National Labs., Albuquerque, NM (USA). [1989]. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8910263–1: JANNAF Combustion Subcommittee meeting, Pasadena, CA (USA), 23-27 Oct 1989). Order Number DE90001656. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An experimental system is being developed to study the fast transient kinetics governing solid-phase decomposition and subsequent interaction with decomposition products. The first phase of this work addresses the decomposition step. The experimental system integrates a thin-film sample configuration with two chemical diagnostic techniques, time-of-flight mass spectrometry and time-resolved infrared spectral photography, and a pulsed-laser heat source. This system is designed to examine both condensed-phase mechanisms and concurrent gas-phase species evolution from samples at temperatures up to 1000°C with microsecond temporal resolution. Tests are underway to demonstrate and assess the use of thin-film samples with the experimental system. Results of these tests, the diagnostic capabilities of the experimental system, and the advantages, preparation and characterization of thin-film samples are presented. 19 refs., 4 figs.

3382 (UCRL–101879) **Burning rates of two cast nitramine explosives using a hybrid closed bomb-strand burner.** Tao, W.C.; Costantino, M.S.; Ornellas, D.L. Lawrence Livermore National Lab., CA (USA). Aug 1989. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890926–3: 9. international symposium on detonation, Portland, OR (USA), Sep 1989). Order Number DE90002785. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The burn rate of two HMX-based cast explosives, RX-08-EL and RX-40-AP, is measured to pressures above 650 MPa using a hybrid closed bomb-strand burner. The hybrid design allows the simultaneous measurement of pressure and regression rate, in each experiment, over a large range of pressures. RX-08-EL is a high performance extrusion cast explosive with low sensitivity, and RX-40-AP is a cast-cured explosive with a mono-modal HMX particle size distribution. Up to 650 MPa, both explosives exhibit a planar burning mechanism with the regression rate obeying the classical aP^n formalism. Upon cycling to 400 MPa, unloading, and re-pressurizing, the RX-08-EL explosive exhibited a significant increase (an order of magnitude) in its burn rate.

4502 Nuclear

Refer also to citation(s) 3081, 3312, 3313, 3474, 3489

3383 (AD-A–207407/8/XAB) **Analysis of fallout prediction codes including the Fallout Assessment system (FAS). Master's thesis.** Gaudette, R.D. Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering. Jan 1989. 107p. (AFIT/GEP/GNE–89M-2). Available from NTIS, PC A06/MF A01.

The purpose was to develop a method to analyze nuclear weapon fallout codes and apply the method to one code as an example. Codes may be evaluated by three methods: (1) comparison of code prediction with data from an actual burst, (2) comparison with an accepted benchmark code, (3) analysis of the degree of approximation of physical laws used in the code was used in this study. Some of the attributes upon which evaluation should be based are: initial cloud model, local fallout activity, activity distribution in cloud particles, source normalization constant k, and the arrival rate of activity on the ground g(t). Of these attributes, many cannot be obtained directly from code output, they must be determined from an analysis of the source code or by consulting the code's author. This thesis discusses the code attributes that must be evaluated, and describes methods for evaluation based on code output. Finally, the analysis techniques are applied to the Defense Nuclear Agency Fallout Assessment System (FAS). It was found that the physics approximations used by FAS are generally good. However the code has a tendency to over-predict the dose rate close to the detonation point by as much as a factor of 25.

3384 (AD-A–210657/3/XAB) **Analysis of forest-fire smoke using satellite imagery. Master's thesis.** De Vries, P.J. Naval Postgraduate School, Monterey, CA (USA). Mar 1989. 81p. Available from NTIS, PC A05/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

NOAA-9 AVHRR data from 17 and 18 September 1987 were used to perform forest-fire smoke analysis and tracking. The analysis included alignment, subtraction and division of image digital values to produce an Aerosol Particle Size Index (S12) after Frost (1988). S12 provides information about the slope of the aerosol particle size distribution curve and can be used to infer particle-size distribution changes over time. The results provide evidence that the smoke aging process may be successfully studied using satellite imagery, provided careful analysis and removal of background effects are performed.

3385 (AD-A–210663/1/XAB) **Modeling casualties in nuclear warfare. Final report.** Klopcic, J.T.; Watson, D.L. Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab. Jul 1989. 39p. (BRL-MR–3771). Available from NTIS, PC A03/MF A01.

In this report, the authors summarize the casualty criteria currently accepted for the estimation of casualties to the various nuclear environments. For the blast and thermal environments, comparisons are made with criteria currently used in the assessment of conventional weapon casualties. In the area of radiation effects, the report also includes a summary of performance degradation methodology developed in the DNA Intermediate Nuclear Dose Program and an indication of its relationship to the most recent radiation casualty criteria. Finally, the report concludes with a discussion of the application of these casualty criteria and models in nuclear warfare simulations.

3386 (AD-A–210737/3/XAB) **Engineering Assignment 5, E-4B surveillance methodology. Final report.** Wang. Boeing Military Airplane Co., Seattle, WA (USA). 29 Sep 1986. 146p. Available from NTIS, PC A07/MF A01.

The development of the E-4B aircraft included adding the protection required to ensure that the aircraft would survive the nucleal-attack environment defined in the system specification. This was accomplished in two major phases. The first, the 1b-2 Phase, included the primary hardening analysis, design, and verification efforts. This phase produced the first, nuclear-hardened E-4B aircraft, Aircraft no. 4 (75-00125). The second major phase, the 1C-1 Phase, converted the three existing E-4A aircraft, Aircrafts No. 1 (73-01676), No. 2 (73-01677), and No. 3 (74-00787) to the E-4B configuration. This included installing the same hardening designs on the these three aircraft. Additional analysis and design required by differences between these aircraft or by modifications to the aircraft subsequent to delivery of aircraft No. 4 were also performed during the 1C-1 phase.

3387 (AD-A–210903/1/XAB) **Battlefield nuclear weapons and tactical gridlock in Europe.** Cannon, M.W. Army Command and General Staff Coll., Fort Leavenworth, KS (USA). School of Advanced Military Studies. 17 Nov 1988. 60p. Available from NTIS, PC A04/MF A01.

This paper addresses the issue of whether the use of tactical nuclear weapons in a war in Europe will bring about a tactical stalemate or gridlock. The TRADOC Common Teaching Scenario is used for a guide as to the area, forces employed, general situation, and nuclear weapons available to commanders on both sides. With these considerations, two iterations of a war game were run and the areas contaminated and rough levels of casualties calculated. An analysis of how this may affect battlefield maneuver is made and other issues which may affect the use of battlefield nuclear weapons are presented. The paper concludes with a discussion of areas that require additional research to further develop the answer to the research question.

3388 (NVO–209-Rev.9) **Announced United States nuclear tests, July 1945–December 1988.** USDOE Nevada Operations Office, Las Vegas, NV (USA). Office of External Affairs. Sep 1989. 64p. Sponsored by U.S. DOE Defense Programs. Order Number DE90001812. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document lists chronologically and alphabetically by event name all nuclear tests conducted and announced by the United States from July 1945 through December 1988, with the exception of the GMX experiments. The 24 GMX experiments, conducted at the Nevada Test Site (NTS) between December 1954 and February 1956, were "equation-of-state" physics studies that used small chemical explosives and small quantities of plutonium. Several tests conducted during Operation Dominic involved missile launches from Johnston Atoll. Several of these missile launches were aborted, resulting in the destruction of the missile and nuclear device either on the pad or in the air.

3389 (SAND–86-2189C) **Reverse Hopkinson bar testing.** Bell, W.K.; Davie, N.T. Sandia National Labs., Albuquerque, NM (USA). [1987]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-870566–3: Institute of Environmental Sciences annual meeting, San Jose, CA (USA), 4-8 May 1987). Order Number DE90002971. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A new test technique, Reverse Hopkinson Bar Testing, has been developed for mechanical shock simulation. A long cylindrical aluminium bar is used as a projectile to strike a test item. The strain wave in the bar is measured and from this, this input force to the test item can be calculated. This method generates a trapezoid shaped force-time history at the bar, test item interface. The test technique is described in detail, and it will be shown how the peak force pulse duration can be independently controlled. Reverse Hopkinson Bar testing of a Nuclear Depth Bomb will be described where the technique is used to simulate the water impact force the weapon experiences upon striking the ocean surface. Results of the simulation are compared with field test data. 4 refs., 9 figs.

3390 (UCRL–100794) **Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole.** Hearst, J.R.; Conaway, J.G.; Mathews, M.A.; Barber, J.W. Lawrence Livermore National Lab., CA (USA). Oct 1989. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891057–3: 3. international symposium on borehole geophysics, Las Vegas, NV (USA), 2-5 Oct 1989). Order Number DE90002784. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When a nuclear explosive is tested underground, rock in the immediate vicinity of the explosion is heated to very high temperatures. If any of that rock contains carbonates (dolomite or calcite), these are dissociated and the carbon may combine with oxygen to form carbon dioxide, increasing the hazard of a delayed leak. We are trying to adapt a commercial neutron-induced gamma-ray spectroscopy log to estimate carbonate content in emplacement (2- to 4-m diameter) boreholes at the Nevada Test Site. Such a log would test a much larger (and therefore presumably more representative) sample than the few grams currently used in sample analysis and would be continuous rather than discrete. 14 refs., 15 figs., 1 tab.

3391 **Defensive technologies for Europe.** Canavan, G.H. (Los Alamos National Lab. (US)). pp. 218 of Strategic defense and the Western alliance. Lakoff, S.; Willoughby, R. Lexington Books, D.C. Heath and Co., Lexington, MA (1987).

This discussion reviews the strategic defense technologies applicable to the European theater and assesses their expected performance there. It summarizes the more extensive discussions of defensive concepts and countermeasures found in Theater Applications of Strategic Defense Concepts, as well as the more detailed treatment of cost-effectiveness, survivability, and stability in Strategic Defense Concepts for Europe. Where possible, the basis for numerical estimates is given in the text.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

Refer also to citation(s) 2128, 2291, 2361

3392 (Juel-Spez–493) **Documentation of the first measuring campaign of September 8-12, 1986 within the framework of the research project 'Dispersion of pollutants in complex terrain after short-term emissions'.** Zeuner, G.; Heinemann, K.; Mextorf, O.; Mueller, S. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Sicherheit und Strahlenschutz. Jan 1989. 115p. (In German). Order Number DE90721901. Available from NTIS (US Sales Only), PC A06/MF A01.

In the first part of this documentation the geographic conditions of the terrain are examined and the metereological measuring systems used are described. The second part deals with the data obtained while only a small part of the results is presented in figures due to the enormous amount of data material gathered. In particular results that show the influence of the hill on the flow conditions are presented. The macroclimate prevailing at the time of measurement favoured the formation of inversions in the night. The comparatively moderate wind forces and the changes in the wind direction at the hill which are connecteed with these inversions are clearly recognizable. In the last part the structure of the data stored on the magnetic tape is explained. The data were combined into standardized data records on data carriers to make further scientific evaluations easier. With the agreement of the Federal Ministry for the Environment the complete data material was made available for interested users. (orig./KW).

3393 (PB–89-218739/XAB) **Global tropospheric chemistry: Chemical fluxes in the global atmosphere.** Lenschow, D.H.; Hicks, B.B. National Center for Atmospheric Research, Boulder, CO (USA). May 1989. 112p. Available from NTIS, PC A06/MF A01.

See also PB–85-125524.

In October 1987, NSF, NASA, and NOAA jointly sponsored a workshop at Columbia University to assess the experimental tools and analysis procedures in use and under development to measure and understand gas and particle fluxes across this critical air-surface boundary. This report presents the results of that workshop. It is published to summarize the present understanding of the various measurement techniques that are available, identify promising new technological developments for improved measurements, and stimulate thinking about this important measurement challenge.

3394 **Ozone and other issues in global atmospheric chemistry.** Wuebbles, D.J.; Kinnison, D.E. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 127E.

Atmospheric chemistry will likely play an important role in determining the future state of climate, and the rate of climate change. Many of the same gases of direct importance to climate changes as greenhouse gases, such as CO_2, CH_4 and several CFCs, also can have indirect effects on climate through their chemical interactions with other important atmospheric constituents. For example, within the troposphere, emissions of CH_4, CO, and NO_x may affect concentrations of ozone, itself a radiatively important gas, and hydroxyl, OH, which, while not radiatively important, has an important impact on atmospheric chemistry as a scavenger of other gases. In the stratosphere, dissociation of the CFCs, CH_4, and N_2O, can lead to significant changes in the ozone distribution. The two-dimensional chemical-radiative-transport model of the troposphere and stratosphere developed at Lawrence Livermore National Laboratory (LLNL) provides a useful tool to study the past effects and potential future changes that such emissions may have on the atmosphere. Using this model the authors describe some of the key current issues in global atmospheric chemistry that relate to climatic change.

3395 **Climate change and its effect on wet-removal processes.** Hales, J.M. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 127C.

Because of the potential for simultaneous change of multiple meterological variables, it is difficult to predict with certainty the impact of future climate change on the wet removal of atmospheric pollutants. In view of this situation it is often expedient to perform modeling sensitivity analyses, wherein individual key variables are

allowed to vary while all others are held constant. This paper presents the results of one such analysis, wherein a warm-frontal storm model has been executed to compute scavenging of nitrogen and sulfur compounds. The temperature boundary conditions are varied from one simulation to the next, while those for other meterological and chemical fields (absolute humidity, winds, pollutants) are held fixed. Comparison of predicted wet-deposition rates from these simulations provides considerable insight on the potential impact of climatic temperature changes on the wet cleansing of the atmosphere.

3396 **A county-level approach to regional resource analysis based on climate simulation.** Schuhardt, S.L. (Biology Department, Northern Arizona University, Flagstaff, Arizona (US)); Cushman, R.M.; Boden, T.A. *Journal of Climate (USA),* 2(2): 113-120 (Feb 1989). DOE Contract AC05-84OR21400.

This paper describes the use of a county-level approximation of the grid cells of a general circulation model as an approach to using environmental and resource data in analyzing the effects of climate change. As a demonstration, the effects are estimated of a possible climate change due to a doubling of atmospheric CO_2 on the production of soybeans using two simple approaches based on grid cell averages of county-level yield data. With the first approach, we assume that the future yields will be determined by current climate-yield relationships. The actual 1978 climate (approximate growing-degree days and precipitation in the growing season) corresponding to 1978 yield levels is calculated. The climate characteristics of grid cells with major (grid cell-averaged yield of 56.9–299.3 kg/ha) and minor (1.6–11.6 kg/ha) soybean yield are estimated. Potential future major and minor yields are then estimated from a simulated changed climate. With the second approach, future yields are estimated using a multiple regression equation that relates yield to simulated June and August temperature and July, August, and September–June precipitation. These two simple analyses, which ignore many important factors such as soil fertility, technological advances, development of new soybean varieties, and the validity of the climate simulations, show that soybean yields might decline in the areas where the crop is now grown, but that soybeam agriculture could expand northwards and eastwards if other factors permit. These analyses confirm that it is possible to perform analyses of the effects of climate change using county-level data, although such analyses would have to consider additional factors before the results themselves would be credible.

3397 **The effect of urban warming on the Northern Hemisphere temperature average.** Jones, P.D. (Climatic Research Unit, School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom (GB)); Kelly, P.M.; Goodess, C.M.; Karl, T. *Journal of Climate (USA),* 2(3): 285-290 (Mar 1989).

The significance of the urban warming effect on large-scale and hemispheric mean temperature series is assessed using estimates of the urbanization bias for stations in the United States produced by Karl *et al.* It is concluded that the Northern Hemisphere landmass average recently compiled by Jones *et al.* may contain a spurious warming trend which is, at the maximum, 0.1 °C over the first eight decades of the twentieth century. This is considerably less than the long-term warming trend observed over the same period.

3398 **Specifying monthly mean surface temperatures in Canada and Alaska from the 500 mb height field.** Klein, W.H. (Department of Meteorolgoy, Cooperative Institute for Climate Studies, University of Maryland, College Park, Maryland (US)); Shabbar, A.; Yang, R. *Journal of Climate (USA),* 2(6): 631-638 (Jun 1989).

Specification equations for monthly mean air temperature anomalies at 68 surface stations in Canada and Alaska are derived by applying a forward selection screening procedure to simultaneous monthly mean 500 mb height anomalies at 110 grid points in the Northern Hemisphere and the previous month's local temperature anomaly. For the annual average, these equations explain about 72% of the temperature variance (on dependent data) by means of only 4.3 variables, but with marked regional and seasonal differences.

3399 **Comparison of GCM and energy balance model simulations of seasonal temperature changes over the past 18 000 years.** Hyde, W.T. (Climate System Research Program, Department of Meteorology, Texas A&M University, College Station, Texas (US)); Crowley, T.J.; Kim, K.; North, G.R. *Journal of Climate (USA),* 2(8): 864-887 (Aug 1989).

The sensitivity of a linear two dimensional Energy Balance Model (EBM) to altered surface albedo and insolation over the last 18 000 years is compared to simulations made with the NCAR Community Climate Model (CCM). The two-dimensional EBM is a more general form of that described in North *et al.* and allows for regionally varying albedos of ice sheets and sea ice. It is shown that the EBM's hemispherically averaged land and sea seasonal temperature departures agree excellently with the CCM's in the Northern Hemisphere. In the Southern Hemisphere the seasonal comparisons are less favorable, although the annual-averaged oceanic temperature departures at glacial maximum agree to within 0.3 °C. Since the CCM used prescribed SSTs (from CLIMAP), whereas the EBMs are calculated, our results suggest that the hemispherically averaged glacial-interglacial SST change estimated by CLIMAP is consistent with the altered energy balance requirements of the earth-atmosphere system. Results also suggest that on the largest scales the seasonal temperature field at the earth's surface may be linearly dependent on changes in orbital forcing and surface albedo. We conclude that the EBM performs well enough to justify its use as an exploratory tool for investigating the effects of altered boundary conditions on the earth's annual temperature cycle.

3400 **Modeling bulk atmospheric drainage flow in a valley.** Dobosy, R.J. (Atmospheric Turbulence and Diffusion Division, NOAA/ARL, Oak Ridge, Tennessee (US)). *Journal of Applied Meteorology (USA),* 28(9): 936-947 (Sep 1989).

Most simulations of bulk valley-drainage flows depend heavily on parameterizations. The 1984 Atmospheric Studies in Complex Terrain (ASCOT) field experiment in Brush Creek Valley, Colorado, provided an unprecedented density of measurements in a natural valley of simple shape, allowing tests of assumptions and parameterizations developed from laboratory measurements and detailed numerical simulations. This paper uses the ASCOT data to test a model that computes total fluxes of mass (volume) and momentum—determining buoyant and pressure-gradient forces from measured temperature profiles, and parameterizing drag, entrainment, and sidewall and tributary drainage. Computed divergences of volume and momentum flux are within a factor of 2 of the Doppler lidar measurements in Brush Creek Valley. The relative importance of individual terms as parameterized in the model is discussed. A major problem for future work is the treatment of the interaction between valley drainage and ambient flow.

5002 Chemicals Monitoring and Transport

Refer also to citation(s) 2013, 2074, 2076, 2077, 2078, 2080, 2421, 2422, 2599, 2696, 2736, 2743, 2747, 2763, 2788, 2794, 2796, 2797, 3229, 3235, 3249, 3250, 3256, 3257, 3370, 3392, 3394, 3395, 3488, 3494, 3552, 3553, 3555, 3559, 3752, 3767, 3770, 3774, 3777, 3781, 3783, 3784, 3787, 3791, 3792

3401 (AD-A–211029/4/XAB) **Are ozone exceedance rates decreasing? Comment on extreme value analysis of environmental time-series: An application to trend detection in ground-level ozone. Technical report, 1 January-31 July 1989.** Raftery, A.E. Washington Univ., Seattle, WA (USA). Dept. of Statistics. Jul 1989. 14p. (TR–165). Available from NTIS, PC A03/MF A01.

R.L. Smith (1989) in his Statistical Science discussion paper, proposed new methods for analyzing extreme values based on the point process view of high-level exceedances, and illustrated them with a detailed analysis of ozone data from Houston, Texas. The methods are powerful and, in particular, the point process of cluster peaks over a high threshold provides a remarkable condensation of the massive data set that he analyzes. It involves little loss of relevant information and permits fairly simple analyses. Smith's conclusion is that there is no trend in the overall levels of the series, but that there is a marked downward trend in the extreme values. It seems hard to find physical explanations for this, and here the evidence is reassessed in terms of a comparison between competing models for the intensity of a Poisson process. This suggests that there is some evidence for a decreasing trend in exceedance rates but that it is rather weak. If there is a trend, it seems more likely to

consist of a fairly abrupt change than a gradual decrease. The possibility that such a change is due to an improvement in measurement technology is discussed. The possibility of long-memory dependence is also considered and the clustering, method used is discussed.

3402 (AD-A–211201/9/XAB) **Electrostatic precipitation of charged particles from a turbulent flow between coaxial cylinders.** Shapiro, M.; Oron, A.; Gutfinger, C. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemical Engineering. Feb 1989. 17p. Available from NTIS, PC A03/MF A01.

Pub. in Jnl. of Colloid and Interface Science, Vol. 127, No. 2, 401-416(Feb 1989).

Transport and deposition of charged particles from a turbulent flow within a cylindrical precipitator are analyzed theoretically. Particle collection efficiency is calculated for different diffusivity models. The effect of particle inertial properties upon the collection rate is studied. It is shown that the Deutsch formula for particle efficiency is valid for moderate values of the applied electrostatic field. The performances of parallel plate and cylindrical precipitators are compared on the basis of the calculated collection efficiencies. The effect of the dielectrophoretic capture mechanism upon the particle-collection rate is evaluated.

3403 (AD-A–211242/3/XAB) **Compliance testing of the Eglin AFB (Air Force Base) asphalt-concrete Batch Plant, Eglin AFB, Florida. Final report, 5-11 March 1989.** Garrison, J.A. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). Jun 1989. 85p. (AFOEHL–89-051EQ0058FEF). Available from NTIS, PC A05/MF A01.

At the request of HQ AFSC/SGPB, stationary source compliance testing for particulate emissions was conducted on the Eglin AFB Asphalt-Concrete Batch Plant, Bldg 572. Testing was requested to determine particulate emissions compliance status with regards to State of Florida Administrative Code, Rules 17-2 (Air Pollution) and 17-4 (Permits) and State of Florida Environmental Regulation Permit No. A046-122393. Testing involved using two types of aggregate, a red clay type material with high percentage of fines and a coarser white sand. Results indicate that emission rates for each type of aggregate were well below state emission limits imposed by Rule 17-2 and Permit no. A046-122393.

3404 (ANL/PPRNT–89-183) **A collaborative effort to model plant response to acidic rain.** Jacobson, J.; Irving, P.; Kuja, A.; Lee, J.; Shriner, D.; Troiano, J.; Perrigan, S.; Cullinan, V. Argonne National Lab., IL (USA). [1989]. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90003002. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Radish plants were exposed three times per week to simulated acidic rain at pH values of 2.6 to 5.4 over the course of four weeks in trials performed at Argonne, Illinois; Ithaca and Upton, New York; Corvallis, Oregon; Oak Ridge, Tennessee; and Toronto, Canada. Uniform genotype, soil media and planting techniques, treatment procedures, biological measurements, and experimental design were employed. Growth of plants differed among trials as a result of variation in greenhouse environmental conditions according to location and facilities. Larger plants underwent greater absolute but lower relative reductions in biomass after exposure to the higher levels of acidity. A generalized Mitscherlich function was used to model the effects of acidity of simulated rain on dry mass of hypocotyls using data from three laboratories that performed duplicate trials. The remaining data, from three other laboratories that performed only one trial each, were used to test the model. 14 refs., 2 figs., 7 tabs.

3405 (BNL–43127-Rev.) **FACE: A free-air facility for fumigation with gaseous air pollutants: Revision.** Lipfert, F.W.; Lewin, K.F.; Hendrey, G.R.; Daum, M.L. Brookhaven National Lab., Upton, NY (USA). Feb 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8906215–1-Rev.: 20. international ICT conference: environmental testing in the 90's, Karlsruhe (Germany, F.R.), Jun 1989). Order Number DE90002292. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A computer-controlled open air test facility is described which is capable of maintaining pollutant gas concentrations at preset levels while allowing natural fluctuations in solar radiation, precipitation, wind conditions, temperature, and relative humidity. The system has been used successfully in various configurations with SO_2, CO_2, and ozone. CO_2 fumigation has been used to evaluate the response of field-grown cotton, using a 22-m diameter fumigation ring. The system is modular and portable and has been tested at Brookhaven National Laboratory (BNL) and in Mississippi; a field of study is planned for 1989 in Arizona. 8 refs., 9 figs.

3406 (BNL–43361) **Vertical distribution of pollutants in the presence of convective storms.** Kleinman, L. Brookhaven National Lab., Upton, NY (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8906154–2: 28. Liege international astrophysical colloquium on our changing atmosphere, Liege (Belgium), 26-30 Jun 1989). Order Number DE90002590. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During the PRECP V field program vertical profiles of CO, NO_y, SO_2, O_3, H_2O_2, aerosol particles and water vapor were measured in the vicinity of convective storms or in air masses which had experienced convection in their recent past. Peak concentrations occur at the altitudes at which the various substances are emitted or formed in the atmosphere. For water vapor, SO_2, CO, NO_y and submicron aerosol particles this is the boundary layer. High concentrations of O_3 occur in the boundary layer where it is photochemically formed and in the upper troposphere as a result of downward transport from the stratosphere. The peak formation rate and the highest concentration of H_2O_2 occurs above the boundary layer. The insoluble pollutants CO and NO_y can be efficiently transported from the boundary layer to upper troposphere. Soluble species such as SO_2 and aerosol particles cannot be similarly transported from the boundary layer to upper troposphere. The observed proportionality between aerosol particles and water vapor is consistent with limits on the upward transport imposed by the sequence of cooling, cloud formation, and removal in precipitation. 6 refs., 3 figs.

3407 (CONF-890814–9) **Environmental quality and the shift to alternative fuels: Progress and interim findings of a Department of Energy study of transition in vehicular power systems.** Saricks, C.L.; Rajan, J.B.; Singh, M.K. Argonne National Lab., IL (USA). 22 Aug 1989. 32p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From American Institute of Chemical Engineer's summer national meeting; Philadelphia, PA (USA); 20-23 Aug 1989. Order Number DE90002178. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The goal of the last component, environmental consideration, is to identify potential environmental, health, and safety constraints and effects that could jeopardize a smooth transition or might render some aspects of transition inadvisable. These effects are not necessarily "better" or "worse," just different. Specific tasks include (a) developing a quantitative estimate of the relative air emissions due to domestic fuel production and vehicular operation of each fuel penetration "scenario" identified by the fuel distribution and vehicle supply component, (b) estimating air quality and waste disposal effects of these scenarios, and (c) defining public and occupational safety and health issues related to domestic fuel and power system production, fuel handling, and vehicular operation. No attempt to quantify or assign a value to net environmental benefits is undertaken as part of the DOE analysis. This report focuses on this third study component, discussing the environmental, health and safety (EH & S) transition issues that have been identified as of July 1, 1989 and describing methodologies to be applied in forthcoming quantitative analyses. As appropriate, findings to date from other components of the study will be cited. The following section, which presents EH & S concerns for each of the three prime candidate alternative fuels, is drawn largely from a forthcoming study progress report.

3408 (CONF-8906244–1) **US Energy use: New technologies and policies in response to global warming.** Streets, D.G.; Bloyd, C.N.; Kenski, D.M. Argonne National Lab., IL (USA). Jun 1989. 39p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Conference on responding to the threat of global warming: options for the Pacific and Asia; Honolulu, HI (USA); 21-27 Jun 1989. Order Number DE90002170. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Energy use and production accounts for by far the largest portion of emissions of greenhouse gases in the United States and the world. The US Environmental Protection Agency (EPA) has estimated that, worldwide, these activities were responsible for 57% of greenhouse warming in the 1980s. Other activities and their respective contributions as shown in Fig. 1 include agriculture, 14%; land use and modification, 9%; chlorofluorocarbon (CFC) use, 17%; and other (nonenergy) industry, 3%. Given this importance of energy activities, it is appropriate that efforts to forestall global warming have focused on these activities. Because the United States consumes the largest share of world energy and thus produces the largest share of greenhouse gas emissions, it is the target of many such efforts. A number of US government responses to global warming have been proposed or are now under way. For example, the 101st Congress has seen 11 bills dealing with global warming issues; a research program on climate change has been promised $190 million for 1990; and the United States has signed the Montreal Protocol to control CFCs. The paper that follows discusses US energy and related emissions of greenhouse gases. Energy use in each sector is briefly characterized and several new technologies for energy use in that sector are described. Finally, national and state policies that offer potential to reduce energy use are discussed. This discussion is limited by space considerations to only a sampling of the many technologies under development and policy options that have been proposed. 20 refs., 12 figs., 6 tabs.

3409 (DOE/ER–0425) **Carbon dioxide and climate: Summaries of research in FY 1989.** USDOE Office of Energy Research, Washington, DC (USA). Office of Health and Environmental Research. Oct 1989. 87p. Sponsored by U.S. DOE Energy Research. Order Number DE90001791. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Scientific and public interest in greenhouse gases, climate warming, and global change has virtually exploded in 1989. The Department's focused research on Co_2 contributed sound and timely scientific information to the myriad of questions produced by the groundswell of interest and concern. Research projects summarized in this document provided the data base that made timely responses possible, and the contributions from participating scientists are genuinely appreciated. The nation's interest has been well served. In the past year, the core CO_2 research has continued to improve the scientific knowledge needed to project future atmospheric CO_2 concentrations, to estimate climate sensitivity, and to assess the responses of vegetation to rising concentrations of CO_2 and climate change. The Carbon Dioxide Research Program's goal is to develop sound scientific information for policy formation and governmental action in response to changes of atmospheric CO_2. During this year, the Program was moved into the Office of Health and Environmental Research and was combined with other atmospheric research activities. The work is now administered by the Atmosphere and Climate Research Division (ACRD). In addition to supporting core CO_2 research and developing a program around the new initiatives, ACRD is responsible for atmospheric science and climate. Its scope includes atmospheric chemistry, numerical modeling, laboratory studies, and field experiments. This Program Summary describes projects funded by the Carbon Dioxide Research Program during FY 1989 and gives a brief overview of the objectives, organization, and accomplishments of that research.

3410 (DOE/ER/60294–T1) **Participation in the MAP3S precipitation chemistry network: Progress report, August 1, 1988–July 31, 1989.** Pennsylvania State Univ., University Park, PA (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER60294. Order Number DE90002755. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Progress is reported on precipitation chemistry at the Penn State Atmospheric Research Site. Hydronium ion, sulfate, and nitrate variations are discussed. Work on cloud chemistry and air chemistry is also briefly discuss. 6 refs., 13 figs. (CBS)

3411 (DOE/ER/60313–4) **Sources of methane in China: A program to estimate the emissions from rice paddies, biogas pits and urban areas: Annual progress report.** Rasmussen, R.A.; Khalil, M.A.K. Oregon Graduate Center, Beaverton, OR (USA). Inst. of Atmospheric Sciences. Oct 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER60313. Order Number DE90003351. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The main objectives of our program are (1) to determine the flux of methane from rice fields in China and estimate the global emissions of methane from rice fields, (2) to determine whether the estimated 7-10 million biogas generators in China are contributing to the global increase of methane, and (3) to conduct exploratory studies of emissions of other environmentally significant trace gases from rice fields and biogas generators. The last two objectives have been fulfilled. 3 refs.

3412 (DOE/ER/60549–3) **Lung cancer risk from inhalation of radon and other pollutants in rats: Comprehensive progress report, March 1, 1987–February 28, 1990.** Burns, F.J. New York Univ., NY (USA). Dept. of Environmental Medicine. [1989]. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60549. (COO–60549-3). Order Number DE90002553. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The goal of these experiments is to establish a quantitative correlation between early DNA damage and cancer incidence that would be helpful for assessing the carcinogenic risk of radon inhaled alone or in combination with specific indoor pollutants. Rat tracheal epithelium will be exposed in vivo to ^{210}Po alpha particles from specially fabricated needles inserted intratracheally. To assess the effect of indoor pollutants the rats will be exposed by inhalation to NO_2 or cigarette smoke. DNA strand breaks, DNA synthesis suppression and basal cell proliferation in the respiratory epithelium will be determined and compared with the cancer incidence and the degree of histopathological damage. Several implant designs by 2 separate suppliers have been considered and tested. Design considerations included the shape of the implant, safety of handling the implant, stability of the implant in contact with body fluid, and stabilization of the implant in the center of the tracheal lumen. Many ideas were tried and rejected before we selected the current design. The implant is a 7.0 mm long hollow needle with an outside diameter of 1.0 mm fabricated of silver alloy. Threaded through the needle lengthwise are three strands of welded dental wire. The dental wire protrudes through both ends and flares outward to stabilize the needle in the center of the airway. The needle is electroplated with various amounts of ^{210}Po to provide tracheal dose rates from 2.0 Gy per minute down to about 2.0 Gy per week. 34 refs., 17 figs.

3413 (DOE/ER/60549–4) **Cancer risk for radon exposure in a polluted environment: Progress report, March 1, 1989–February 28, 1990.** Burns, F.J. New York Univ., NY (USA). Dept. of Environmental Medicine. [1989]. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60549. (COO–60549-4). Order Number DE90002554. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Several implant designs by 2 separate suppliers have been considered and tested. Design considerations included the shape of the implant, safety of handling the implant, stability of the implant in contact with body fluid, and stabilization of the implant in the center of the tracheal lumen. Many ideas were tried and rejected before we selected the current design. The implant is a 7.0 mm long hollow needle with an outside diameter of 1.0 mm fabricated of silver alloy. Threaded through the lumen of the needle lengthwise are three strands of welded dental wire (Figure 1). The dental wire protrudes through both ends and flares outward to stabilize the needle in the center of the airway. The needle is electroplated with the various amounts of ^{210}Po to provide tracheal dose rates from 2.0 Gy per minute down to about 2.0 Gy per week.

3414 (DOE/ER/60655–2) **Regional aerosol deposition in human upper airways: Annual progress report, March 1, 1989–February 28, 1990.** Swift, D.L. Johns Hopkins Univ., Baltimore, MD (USA). 1 Nov 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60655. Order Number DE90003314. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

During the report period significant progress on the quantitative understanding of regional upper airway deposition of airborne particle has been realized. Replicate models of the human upper airways obtained from post-mortem casting of the nasal, oral, pharyngeal, laryngeal and upper tracheal regions and in vivo magnetic resonance imaging (MRI) of the same regions of adults and children

have been employed to determine the overall and local deposition characteristics of aerosols in the ultrafine (1–100 μm diameter) and fine (0.8–12 μm diameter) region. Studies have been carried out for both nasal and oral breathing during inspiratory and expiratory flow at constant flow rates representative of rest and states of exercise. The results of these investigations indicate that particles in the size range of "unattached" radon progeny (1–3 nm) are deposited in both the nasal and oral passages with high efficiency (60–80%) for both inspiration and expiration, with the nasal deposition being somewhat greater (5–10%) than oral deposition. The effect of flow rate on upper airway deposition for both pathways is not great; data analysis indicates that the deposition for all flow rates from 4–50 liters/minute can be grouped by plotting deposition vs $Q^{-1/3}$, where Q is flow rate, a far weaker dependency than observed for inertial deposition. Diffusional transport is the primary mechanism of deposition, and size dependence can be accounted for by plotting, deposition percent vs D^n where D is particle diffusion coefficient and n ranges from 0.5–0.66. 2 refs.

3415 (DOE-tr–89-4) **Contribution to atmospheric pollution of the activities of CSI Italsider in Bagnoli.** (Contributo dell 'attivita' del CSI Italsider di Bagnoli all'inquinamento atmosferico). Palumbo, A. USDOE, Washington, DC (USA). 1989. 37p. Translation source information not available. Sponsored by U.S. DOE Management & Administration. Order Number DE90002739. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The quality of the air in the area of Bagnoli is the result of emissions coming from: industrial activity in the city of Naples; the large amount of automobile traffic which develops both in the metropolitan area as well as along the roads radiating away from the downtown area; from production plants located in the western section of the city; from the meteorological conditions in the mesoscale; and from the local microclimatic conditions connected with the orography of the site. In order to determine the pollution contribution of CSI Italsider in Bagnoli in the western section of the city of Naples, a model of the ATDL (Atmospheric Turbulence and Diffusion Laboratory, Appendix no. 1) steady state type was designed, adapted to the simulation of atmospheric pollution diffusion in urban areas, which was used successfully in other industrialized cities such as St. Louis. The model was then calibrated by means of a comparison between calculated values and those observed over numerous seasons of monitoring in Naples. The calculation program was run in initial time including the emissions coming from the CSI in Bagnoli among the inputs required by the model so as to obtain an overall map of the pollution of anthropical and natural origin coming from all sources in the Naples metropolitan area. It was then run with only the CSI emissions entered into the program.

3416 (KFK-PEF–51) **5th status colloquium of the PEF, March 7-9, 1989 in the Nuclear Research Center in Karlsruhe. Summarizing reviews of the program management.** Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre. Apr 1989. 95p. (In German). Available from Available from Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftreinhaltung (PEF).

This report compiles the summarizing reviews of the program management in the final session of the 5th status colloquium. The full papers, to which the summaries refer, are published in KfK-PEF 50. (orig.).

3417 (N–89-17364) **Feasibility study of methods for stopping the depletion of ozone over Antarctica. Final report.** Texas Univ., Austin, TX (USA). May 1988. 74p. (NASA-CR–184583;NAS–1.26:184583). Available from NTIS, PC A04/MF A01.

Ways of stopping the ozone depletion in the ozone hole over Antarctica were studied. The basic objectives were: (1) to define and understand the phenomenon of the ozone hole; (2) to determine possible methods of stopping the ozone depletion; (3) to identify unknowns about the hole and possible solutions. Two basic ways of attacking the problem were identified. First is replenishment of ozone as it is being depleted. Second is elimination of ozone destroying agents from the atmosphere. The second method is a more permanent form of the solution. Elimination and replenishment methods are discussed in detail.

3418 (N–89-28118, pp. 197-198) **Tropospheric nitric oxide measurements.** Torres, A.L. National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center. 1988. (NASA-TM–101257;NAS–1.15:101257). In *Laboratory for Oceans.* Available from NTIS, PC A12/MF A01.

Nitric oxide (NO) plays a key role in tropospheric photo-chemistry. The photochemical oxidation of hydrocarbons, for example, can serve as either a source or a sink for ozone, depending on the local abundance of NO. Nitric oxide also helps govern atmospheric concentrations of the hydroxyl (OH) radical. The OH radical is the single most important player in photochemical transformations because it controls the atmospheric lifetimes of so many chemical species. Although NO serves as a very effective catalyst in many important chemical processes, its concentration is low enough to normally be expressed in units of parts per trillion by volume (pptv). Consequently, commercially available detectors for NO (with detection limits of about one part per billion) have proven to be unsuitable for use anywhere except in urban areas and near other local pollution sources. Under the sponsorship of NASA's Global Tropospheric Experiment (GTE), Wallops has developed an extremely sensitive detector with a detection limit of a few pptv. The system was specifically designed for aircraft use, with the objective of applying it in global aircraft studies of tropospheric chemistry. Studies with the detector are examined.

3419 (NEI-DK–211) **Hydrogen chloride bonding on dry limestone.** Energiministeriets Energiforskningsprogram. Miljoe og restprodukter. Dam-Johansen, K.; Ibaek Jensen, P.; Weinell, C.E.; Livbjerg, H.; Oestergaard, K. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Kemiteknik. Jul 1989. 18p. (In Danish). Order Number DE90718974. Available from NTIS (US Sales Only), PC A03/MF A01.

Energiministeriets Energiforskningsprogram. Miljoe og restprodukter.; EFP-88.

Resume of a pilot project concerning the chemical reactions involved during bonding of hydrochloric acid with dry limestone. Local acidification caused by HCl air pollution significantly contributes to damage of plants and materials. The incineration of municipal wastes currently produces the highest percentage of HCl pollution in Denmark. (AB).

3420 (NEI-DK–220) **Calculation of air pollution dispersion over a complex terrain with special emphasis on dimensioning of chimney stacks.** Energiministeriets Energiforskningsprogram. Miljoe og restprodukter. Berkowicz, R.; Olesen H.R.; H.R.; Gryning, S.E.; Larsen, S.E. Miljoestyrelsen, Roskilde (Denmark). Luftforureningslab.; Risoe National Lab., Roskilde (Denmark). Dec 1988. 207p. (In Danish). Order Number DE90719157. Available from NTIS (US Sales Only), PC A10/MF A01.

Energiministeriets Energiforskningsprogram. Miljoe og restprodukter.; EFP-84.

The project: "Dispersion of air pollution in complex terrain, with emphasis on coastal regions" was conducted during the years 1985-1987. The subjects investigated, and summarized in this report, were dispersion climatology in coastal regions, wind and temperature structure in coastal regions and over water, turbulence structure in coastal regions and the internal boundary layer, the Oeresund Project tracer experiments (an analysis) and the application of the OML-model for modelling dispersion in coastal regions. No new operational dispersion models have resulted from the project. Due to the complexity of the problem, it is unlikely that coastal dispersion can be simulated by a single code. An evaluation of the OML-model (an operational dispersion code) has shown that under certain conditions such a code can be applied to sources near a coast. The code can be used for estimation air pollution from sources inside the internal boundary layer. This condition will usually be satisfied when the distance to the nearest water body is a least a few kilometers. In a case of a more complicated terrain configuration, a model developed for homogeneous condition will not perform well. This is the situation for transport of pollution across the Oeresund. Analysis of data from this experiment has shown that there will be a uncertainty in model prediction even with use of a more sophisticated model. The growth of the internal boundary

layer was investigated and some simple models was suggested for future studies. A necessary condition for prediction of the growth of the internal boundary layer is the knowledge of the vertical thermal structure along the coastline. Measurements of the coastal temperature profiles are needed to clarify when and what models can be used in this area. (AB) 14 refs.

3421 (NILU/OR–78/88) **NO_X emissions from stationary sources in eastern Europe.** Pacyna, J.M. Norsk Inst. for Luftforskning, Lillestroem (Norway). Nov 1988. 36p. Order Number DE90719389. Available from NTIS (US Sales Only), PC A03/MF A01.

Emission estimates of NO_X from major stationary sources in Eastern Europe are presented together with the NO_X emission factors and the statistics of the production of industrial goods and the consumption of raw materials. The national totals are presented as well as estimate of NO_X emissions from individual sources. Finally, the spatial distribution of the NO_X emissions from stationary sources is given within the EMEP grid of 150 km x 150 km. 13 refs., 1 fig., 10 tabs.

3422 (ORNL/FTR–3424) **[Deposition of atmospheric nitrogen species to forests in North America and Europe]: Foreign trip report, September 24–October 11, 1989.** Lindberg, S.E. Oak Ridge National Lab., TN (USA). 22 Oct 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002067. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler was invited to (1) present an invited seminar at the Juelich Nuclear Center, (2) visit the Landesanstalt fuer Immissionschutz for the State of Nordhein-Westfalen, (3) visit the Institute for Bioclimatology at the University of Goettingen, (4) present an invited plenary lecture at the International Congress on Forest Decline, and (5) visit field sites operated by the University of Freiburg. At Juelich, the traveler presented a joint seminar to the Institutes of Atmospheric Chemistry and Radioagronomy on "Deposition of Atmospheric Nitrogen Species to Forests in North America and Europe." At LIS, he visited the Egge Mountains field sites for discussions of deposition measurements. At the University of Goettingen, where the traveler was on sabbatical assignment during 1987, the progress of joint research was discussed and manuscripts finalized. At the Congress on Forest Decline, he delivered an invited plenary lecture on "Rates of Wet, Dry, and Cloud Deposition to American Forests" and went on an excursion to the Hoeglwald Forest and Frauenhofer Institute research sites. At the University of Freiburg, he visited field sites in the Black Forest where deposition/nutrient cycling research is performed.

3423 (ORNL/FTR–3429) **[Growth and physiology of red spruce in relationship to acidic deposition in the Great Smoky Mountains National Park, USA]: Foreign trip report, September 30, 1989–October 14, 1989.** McLaughlin, S.B. Jr. Oak Ridge National Lab., TN (USA). 25 Oct 1989. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002512. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler attended the first day and a half of the International Conference on Forest Decline Research at Friedrichschafen, Federal Republic of Germany, where he presented a poster, "Growth and Physiology of Red Spruce in Relationship to Acidic Deposition in the Great Smoky Mountains National Park, USA," by S.B. McLaughlin, C.P. Andersen, N.T. Edwards, P.J. Hanson, M.J. Tjoelker, and W.K. Roy. This stopover was a preface to the principal trip to Russia as part of a joint US-USSR Environmental Protection Agreement designed to increase exchange between scientists involved in pollution-related research. The traveler was a guest of Dr. Sergei Semenov of the USSR State Committee for Hydrometeorology and Control of Natural Environment, USSR Academy of Sciences. With a colleague, Dr. Al Heagle of the Agricultural Research Service of the US Department of Agriculture (USDA), he visited four Soviet research installations, and a Biosphere Reserve field research site while traveling from Pushchino, 100 km south of Moscow, to Moscow, and on to Leningrad over a ten-day period.

3424 (ORNL/FTR–3434) **[The cause of the glacial to interglacial atmospheric CO_2 change]: Foreign trip report, October 14, 1989–October 24, 1989.** Peng, Tsung-Hung. Oak Ridge National Lab., TN (USA). 24 Oct 1989. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002829. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler attended the Third International CO_2 Conference at Hinterzarten, Federal Republic of Germany, and presented two papers, one entitled "The Cause of the Glacial to Interglacial Atmospheric CO_2 Change: A Polar Alkalinity Hypothesis," and the other entitled "Global Net CO_2 Flux Across the Sea-Air Interface Based on the Observed pCO_2 in Surface Water." Nine sessions on various special topics were held. These sessions, all of great interest to the Global Carbon Cycle Research Program at Oak Ridge National Laboratory, included (1) ice core CO_2 measurement, (2) causes of glacial-interglacial CO_2 variations, (3) atmospheric CO_2 observation, (4) isotopes in the carbon cycle, (5) exchange of carbon between atmosphere and land biota, (6) land biota and the carbon cycle, (7) marine biota and the carbon cycle, (8) oceanic pCO_2, and air-sea exchange, and (9) ocean modeling and oceanic processes. Sixty papers were presented orally, and 22 others were presented in poster sessions.

3425 (ORNL/FTR–3449) **[The role of oceans in determining atmospheric CO_2]: Foreign trip report, October 14, 1989–October 22, 1989.** Sarmiento, J.L. Oak Ridge National Lab., TN (USA). 27 Oct 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002653. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

J.L. Sarmiento presented two papers at the Third International Conference on Analysis of Atmospheric CO_2 Data Present and Past. The first paper, "On the Role of the Oceans in Determining Atmospheric CO_2," concerned primarily the work that is being carried out in collaboration with M.J.R. Fasham on the development of ecosystem models for predicting the possible role of changes in the biological cycling of carbon in affecting atmospheric CO_2 levels. The second paper, 3-D Ocean Models of Anthropogenic CO_2 Uptake," concerned the work being carried out in collaboration with U. Siegenthaler on simulating the uptake of anthropogenic CO_2 by the oceans in the absence of any changes in the biology. Sarmiento also met with Siegenthaler to plan a future series of oceanic anthropogenic CO_2 uptake experiments and listened to a series of presentations on recent work in this area, of which the atmospheric measurements and models were of considerable value. The International Geosphere-Biosphere Program Panel 5 meeting was held in order to work on the draft of a plan for modeling as part of this program.

3426 (ORNL/FTR–3452) **[Discussions of global environmental problems]: Foreign trip report, October 14, 1989–October 21, 1989.** Krahl-Urban, B. Oak Ridge National Lab., TN (USA). 2 Nov 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002747. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler visited the Oak Ridge National Laboratory (ORNL) at the request of the Environmental Sciences Division to provide programmatic interpretations and technical overviews of research topics addressing international environmental issues. Many of today's environmental problems can no longer be considered as regional-scale impacts. Global warming, acidification, ozone depletion, drought, deforestation, and air pollution effects are global-level processes that can only be effectively approached by international scientific cooperation. The traveler's recommendations for the final planning and coordination of international environmental issues emphasized focusing on international cooperation with research institutions in West Germany and in other countries of the European Community. Several key global environmental issues are addressed by the Juelich Nuclear Research Center (KFA Juelich), West Germany. Scientific cooperation with KFA Juelich should be promising in theoretical ecology, systems analysis, and toxicology. Scientific exchange between ORNL and KFA Juelich in environmental sciences has been initiated by the traveler.

3427 (ORNL/TM–11120) **Red spruce decline—Winter injury and air pollutants.** Roberts, T.M. Oak Ridge National Lab., TN

(USA). Oct 1989. 23p. Sponsored by Electric Power Research Institute. DOE Contract AC05-84OR21400. TVA 1610-1610-A1. Order Number DE90002632. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There has been a widespread decline in growth of red spruce (Picea rubens Sarg.) since 1960 in the eastern United States. There is evidence that this decline is at least partly attributable to age- and density-related growth patterns, particularly at lower elevations. Mortality has been severe at high elevation sites where similar episodes have occasionally occurred in the last 100 years. At these sites, periods of low growth preceding 1960 were related to periods with warm late summers and cold early winters. Since 1960, this relationship no longer holds, although there is an association with unusual deviations from mean temperatures. There are field reports that one of the main causes of reduced growth and mortality is apical dieback induced by severe winter conditions. Preliminary observations suggest that high elevation red spruce may not be sufficiently hardened to tolerate low autumn temperatures. However, appearance of injury in the spring, association of injury with wind exposure and correlation of provenance susceptibility with cuticular transpiration rates, including the importance of desiccation injury. Sensitivity to both types of winter injury may be increased by air pollutants (particularly ozone and less probably, acid mist or excess nitrogen deposition). Nutrient deficiency (particularly magnesium and to a lesser extent potassium) may also increase cold sensitivity. The nature and extent of these interactions are being actively researched for red spruce. 48 refs.

3428 (PB–89-215669/XAB) **Early detection of health hazards due to asbestos exposure. Final report.** Valic, F. Andrija Stampar School of Public Health, Zagreb (Yugoslavia). Dept. of Occupational Health. 1989. 49p. Available from NTIS, PC A03/MF A01.

See also PB–83-244434.

The prevalence of nonspecific respiratory symptoms in workers exposed to asbestos during asbestos mining and processing were examined. An assessment was made of lung function and radiological changes in these workers. Emphasis was placed on establishing a relationship between the concentration of airborne dust, the length of exposure, and the total exposure with the pulmonary impairment the worker suffered. The study was conducted at two mines, two factories producing asbestos cement products, and one factory manufacturing asbestos textiles and friction materials. Examinations were made of 1,242 asbestos workers and a comparison group of 1,950 workers. Each respiratory symptom analyzed was more common in males than in females and in smokers than in nonsmokers. In 41 of the 897 men, asbestos bodies were recorded. The presence of asbestos bodies was not related to age, duration of exposure, or to the total exposure level. All the symptoms found were much less related to asbestos-fiber years than to total particle years of exposure. Radiological findings indicated that only the prevalences of small opacities increased more or less consistently with the duration of exposure to asbestos, asbestos-fiber years and total-particle years. Some evidence was found of a harmful effect of simultaneous smoking and exposure.

3429 (PB–89-216097/XAB) **Ozone depletion, greenhouse gases, and climate change.** National Academy of Sciences, Washington, DC (USA). Commission on Physical Sciences, Mathematics, and Resources. 1989. 137p. Available from NTIS, PC A07/MF A01.

Library of Congress catalog no. 88-31544.

Ozone depletion in the stratosphere and increases in greenhouse gases in the troposphere are both subjects of growing concern - even alarm - among scientists, policy makers, and the public. At the same time, recent data show that these atmospheric developments are interconnected and in turn profoundly affect climatic conditions. To arrive at a better understanding of this complex relationship, major institutions in the field of atmospheric study convened a symposium of noted researchers. In the volume, they present the results of their most recent research, with the most up-to-date data and theories available on ozone depletion, greenhouse gases, and climatic change.

3430 (PB–89-217814/XAB) **Information on substances for review as toxic air contaminants. Summary report, January 1984-February 1989 (Final).** Jones, M. California State Air Resources Board, Sacramento, CA (USA). Stationary Source Div. Feb 1989. 158p. (ARB/SSD–89-01). Available from NTIS, PC A08/MF A01.

This report summarizes information on the health effects, uses, emissions, ambient concentrations, and atmospheric persistence of substances in two categories. The categories have been established by the California Air Resources Board in consultation with the California Department of Health Services. Both categories are concerned with the review of substances as possible toxic air contaminants. One category consists of substances that have been nominated but not scheduled for review. The second category consists of substances for which more-conclusive health information is needed before the substances can be scheduled for review. Because the report presents information necessary for the selection of substances to enter the journal-review process, the report does not deal with substances already identified as toxic air contaminants or substances now in the review process.

3431 (PB–89-218788/XAB) **Comparison of 0600-0900 AM hydrocarbon compositions obtained from 29 cities.** Lonneman, W.A. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab. 1989. 16p. (EPA–600/D-89/010). Available from NTIS, PC A03/MF A01.

This report describes and compares 0600-0900 AM nonmethane organic carbon compound data from 29 cities collected during summer periods of 1984 and 1985. Considerable differences are observed in those areas that are anticipated to have different volatile organic compound emissions. Range of benzene and toluene concentrations are presented for the 29 urban areas. It appears that variation in the observed concentration range is more evident for toluene than benzene. This observation suggests that there may be more discrete sources for toluene than benzene.

3432 (PB–89-220024/XAB) **Effects of acid deposition on painted wood substrates.** Balik, C.M.; Fornes, R.E.; Gilbert, R.D.; Williams, R.S. North Carolina State Univ., Raleigh, NC (USA). Jul 1989. 48p. Available from NTIS, PC A03/MF A01.

This research program identifies early failure processes associated with acidic deposition on painted-wood-substrate systems. Effects observed during short-term accelerated exposure studies are as follows: FTIR, NMR, and Sol-gel analysis indicate that SO_2 attacks the base terpolymer of latex polymeric coating in the presence of UV radiation. The polymer is stable upon exposure to SO_2 alone, either gaseous or aqueous as sulfurous acid. Sulfurous acid diffuses through both oil-alkyd and latex coatings and can degrade lignin of the wood substrate. Field and laboratory studies indicate that $CaCO_3$ and ZnO are removed from latex paints during exposures. The removal rate decreases with increasing pH. Discoloration or yellowing of $CaCO_3$ containing paints on wood substrates was observed after three months field exposure. Based on the findings, it is recommended that research be continued to develop dose-response relationships for the effects of acid deposition on coated-wood-substrate systems.

3433 (PB–89-221030/XAB) **In-depth industrial-hygiene survey report on styrene exposure at Fiberform, Spokane, Washington, January 16-18, 1979.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Industrial Hygiene Section. Nov 1979. 41p. (IWS–078.23). Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

An industrial-hygiene survey was conducted at Fiberfoam in Spokane, Washington on January 16 to 18, 1979 to document worker exposure to styrene. The facility manufactured fiberglass reinforced plastic boats and employed 388 production workers. The manufacturing potential and past exposures, controls, and medical, industrial hygiene, and safety programs were reviewed. Tube sampling for styrene and acetone indicated concentrations ranging from 18.2 to 179 parts per million (ppm) and 9.77 to 235 ppm, respectively. Styrene exposures were highest for workers in the laminating areas. In many instances, styrene concentrations exceeded the OSHA standard of 100 ppm. The ventilation system in the laminating areas needed maintenance and could be replaced with portable circular fans. Protective work practices could be improved. Review of the ventilation maintenance program, institution of an instructional program of the use and maintenance of protective equipment, and

reorganization of the laminating and chopping operations are recommended.

3434 (PB–89-221055/XAB) **In-depth industrial-hygiene survey report on styrene exposure at Larson Industries, Incorporated Boat Plant, Little Falls, Minnesota, February 27-March 1, 1979.** Crandall, M.S. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Industrial Hygiene Section. Sep 1989. 39p. (IWS–078.28). Available from NTIS, PC A03/MF A01.

Worker exposure to styrene was surveyed at Larson Industries Incorporated, Minnesota from February through March 1979. The company manufactures fiberglass reinforced plastic boats. There are 150 workers at the facility, 100 of these are in the production area, and 35% of the production workers are women. Workplace conditions, job types, production processes, past exposures, and medical and industrial surveillance programs were reviewed. A total of 67 charcoal-tube samples were collected and analyzed for styrene and acetone. Concentrations averaged 82.4 parts per million (ppm) and 64.4 ppm, respectively. Many of the styrene samples exceeded the OSHA standard of 100 ppm. The ventilation system failed to control styrene concentrations during winter months. Proper work practices were followed, but exposures were related to the type of job being performed. Charcoal-tube sampling was an effective and reliable technique. It is recommended that the general lamination areas be targeted for new engineering design to reduce styrene exposures and that a program that includes proper fitting and maintenance procedures for respirators be instituted.

3435 (PB–89-221113/XAB) **Maintain and operate California Air Resources Board field fumigation facility for experimental use. Final report, 17 December 1987-30 June 1989.** Olszyk, D.M. California Univ., Riverside, CA (USA). Statewide Air Pollution Research Center. Jun 1989. 29p. Available from NTIS, PC A03/MF A01.

The Statewide Air Pollution Research Center (SAPRC) has had a continuing mission to investigate the effects of air pollutants on both agricultural crops and native vegetation. To further this mission, SAPRC personnel have maintained the California Air Resources Board (ARB) field-exposure facilities at the Experiment Station at the University of California, Riverside for over seven years. The chamber facilities have been used for a wide variety of experiments. Over the past year, a total of five studies were completely or partially carried out in these facilities. ARB-funded studies included: a determination of the effects of ambient ozone on Valencia oranges, and an evaluation of hydrocarbon emissions from vegetation. Studies funded from other sources included an investigation on the effects of ozone and sulfur dioxide on quaking aspen and perennial ryegrass, investigation of the effects of ozone and sulfur dioxide on alfalfa, and a pilot investigation of the long-term injury effects of ozone on conifer seedlings.

3436 (PB–89-221220/XAB) **New chemical alternatives to chlorofluorocarbons and halons. Report for August 1988-February 1989.** Bare, J.C.; Smith, N.D.; Adcock, J.L. Tennessee Univ., Knoxville, TN (USA). Dept. of Chemistry. Feb 1989. 10p. Available from NTIS, PC A02/MF A01.

This paper describes a determination of the basic properties of laboratory quantities of potential alternative compounds which may be used to replace chlorofluorocarbons (CFCs) and halons listed in the Montreal Protocol for Substances that Deplete the Ozone Layer. The property testing currently posed for investigation was designed to assist in the determination of applicability for replacements for CFCs and halons as refrigerants, fire extinguishants, solvents, or foam-blowing agents. The compounds chosen are currently being synthesized by aerosol fluorination, a process which is described in the paper. The actual chemical equations and experimental yields are included.

3437 (PB–89-221246/XAB) **Asbestos-fiber reentrainment during vacuuming and wet cleaning of carpet at a captive research site.** Kominsky, J.R.; Freybery, R.W.; Cain, W.C.; Wilmoth, R.C.; Powers, T.J. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 31 Mar 1989. 22p. (EPA–600/D-89/055). Available from NTIS, PC A03/MF A01.

A study was conducted to compare the effectiveness of alternative carpet-cleaning techniques and to evaluate the potential for asbestos-fiber reentrainment during cleaning of carpet contaminated with asbestos. The equipment was evaluated at two carpet contamination levels. Airborne asbestos concentrations were determined before and during carpet cleaning. Overall, airborne asbestos concentrations were two to four times greater during the carpet-cleaning activity. The level of asbestos contamination and the type of cleaning method had no statistically significant effect on the relative increase of airborne asbestos concentrations during carpet cleaning.

3438 (PB–89-221253/XAB) **Statistical evaluation of airborne asbestos measured before, during, and after abatement.** Kominsky, J.R.; Freyberg, R.W.; Powers, T.J.; Wilmoth, R.C. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 31 Mar 1989. 15p. (EPA–600/D-89/054). Available from NTIS, PC A03/MF A01.

A statistical evaluation was made of airborne asbestos concentrations measured before, during, and after removal of asbestos-containing fireproofing at three university buildings. Of the three sites studied, all passed the AHERA z-test when the work-area asbestos levels were compared to perimeter levels (outside the abatement area but inside the building). Two sites also passed the z-test when work area and outdoor air levels were compared. At one site, contamination of the perimeter area occurred at some point during the abatement project. Had this area been used in the z-test clearance comparison, a contaminated site would have been falsely released.

3439 (PB–89-221261/XAB) **Destruction of volatile organic compounds using catalytic oxidation. Report for April 1987-December 1988.** Kosusko, M.; Nunez, C.M. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. Dec 1988. 19p. (EPA–600/D-89/079). Available from NTIS, PC A03/MF A01.

This paper discusses the application of catalytic oxidation to four types of air-emission sources: ground-water stripping operations, graphic-arts facilities, flexographic printing plants, and latex-monomer production. Characteristics of each of these emissions are discussed, along with the catalytic technology used to control them. In addition to key emission-stream characteristics, the paper discusses hazardous air-pollutant characteristics that affect the applicability of catalytic oxidation.

3440 (PB–89-221279/XAB) **Use of bioassay methods to evaluate incinerator emissions.** Watts, R.R.; DeMarini, D.M.; Linak, W.P.; Lemieux, P.M.; McSorley, J.A. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 14p. (EPA–600/D-89/068). Available from NTIS, PC A03/MF A01.

The organic components in combustion emissions are composed of thousands of chemicals. Analyzing such a complex mixture for the presence of even a few selected chemicals is difficult and provides information on only a fraction of the chemicals present. Reliance on such limited chemical analysis for determining possible health effects may ignore the contribution of many other chemical components of the effluent. Because combustion emissions are complex mixtures, they have been evaluated as such, rather than by studying a few selected chemicals that might be present. The Salmonella (Ames) assay was used to determine the mutagenicity associated with particles from the effluent of municipal-waste combustors, from ambient air collected near a municipal-waste combustor, and from the effluent of a pilot-sized rotary kiln in which polyethylene was combusted. Filter samples were extracted with dichloromethane, and concentrated extracts were solvent exchanged into dimethyl sulfoxide for bioassay.

3441 (PB–89-221287/XAB) **Mobile air-conditioner refrigerant evaluation. Report for April 1988-March 1989.** Harmon, D.L.; Rhodes, W.J.; Weitzman, L. Acurex Corp., Research Triangle Park, NC (USA). Mar 1989. 17p. Available from NTIS, PC A03/MF A01.

This paper discusses an evaluation of refrigerant from mobile air conditioners. The data gathered indicate that CFC-12 refrigerant does not degrade significantly with use. Furthermore, while small amounts of contaminant are removed with the refrigerant during servicing, most of the contaminants remain with the compressor oil. Current servicing practices do not require that the compressor oil be

changed unless the compressor is replaced. The presence of HCFC-22 in concentrations above the specification for new CFC-12 (0.5%) is rare; it occurred in less than 1% of the 227 cars tested. HCFC-22 contaminant quickly leaks out of the automotive air conditioner through hoses and does not appear to cause operational problems while in the system.

3442 (PB–89-221337/XAB) **US and Canadian emissions inventory, 1985. Report for March-September 1988.** Tax, W.; Pahl, D.; Vena, F. Alliance Technologies Corp., Chapel Hill, NC (USA). 1988. 22p. Available from NTIS, PC A03/MF A01.

This paper discusses efforts by the U.S. and Canada to develop an accurate and highly detailed 1985 emissions inventory which focuses on three pollutants (SO_2, NOx, and VOCs) believed to play a critical role in the formation of acid deposition, and also includes information on species such as HCl, HF, NH3, and alkaline particulate matter. The 1985 emissions inventory is also designed to meet a number of research objectives for the U.S. National Acid Precipitation Assessment Program. The U.S. and Canadian data-collection methodologies exhibited differences in data formats, classifications of point and area sources, emission factors, source classification codes, units of measurement, key data elements, and quality-control checks. U.S. and Canadian modeling inventories differ in their respective grid sizes, allocation factors, and species classes for VOCs and total suspended particulates. The inventory methodologies used by each country were adapted and standardized to ensure consistent processing of data.

3443 (PB–89-221345/XAB) **Calcination of calcium hydroxide sorbent in the presence of SO_2 and its effect on reactivity. Report for October 1988-March 1989.** Jozewicz, W.; Kirchgessner, D.A. Acurex Corp., Research Triangle Park, NC (USA). 6 Apr 1989. 31p. Available from NTIS, PC A03/MF A01.

The paper discusses the calcination of $Ca(OH)_2$ sorbent in the presence of SO_2 and its effect on reactivity. When $Ca(OH)_2$ is calcined in an isothermal flow reactor with 300 ppm or less SO_2, the structure of the sorbent is characterized by retention of higher pore volumes and surface areas than when calcined in the absence of SO_2. When reinjected into the isothermal flow reactor (1000 C, 3000 ppm, 0.8 s), a higher level of reactivity with SO_2 is observed for the SO_2-modified calcine than for the unmodified sorbent. Structural evidence suggests that a slower initial rate of sintering in the modified calcine accounts for its enhanced reactivity. It is postulated that deposition of small amounts of CaSO4 on pore faces and along crystal boundaries retards the solid state diffusion process responsible for sintering. The effects on sintering and reactivity of various combinations of residence time (0.6 - 2.0 s) and SO_2 concentration (10 - 50 ppm) during precalcination have been tested.

3444 (PB–89-221352/XAB) **Bench-scale evaluation of calcium sorbents for acid-gas emission control. Report for October 1988-March 1989.** Jozewicz, W.; Chang, J.C.S.; Sedman, C.B. Acurex Corp., Research Triangle Park, NC (USA). Apr 1989. 29p. Available from NTIS, PC A03/MF A01.

This paper gives results of an evaluation of calcium sorbents for acid gas emission control for effectiveness in removing SO_2/HCl and SO_2/NOx from simulated incinerator and boiler flue gases which is used in municipal solid waste disposal. All tests were conducted in a bench-scale fixed-bed reactor simulating fabric filter conditions in an acid gas removal process. Reagent grade $Ca(OH)_2$ was used to establish baseline sorbent performance. Several additives were subsequently tested to determine optimum sorbent combinations for SO_2/NO control. As with SO_2/HCl, calcium silicate has been shown to be superior for SO_2/NO capture. Some implications for larger-scale process configurations and sorbent selection for HCl/SO_2/NO control are discussed.

3445 (PB–89-222665/XAB) **Effects of air pollutants on photosynthesis, vegetative growth, and development of grapevines in the San Joaquin Valley of California. Final report, February 1987-February 1989.** Williams, L.E.; Roper, T.R.; Brewer, R.F. California Univ., Davis, CA (USA). 25 Feb 1988. 44p. Available from NTIS, PC A03/MF A01.

Mature Thompson Seedless grapevines were exposed to charcoal-filtered air or ambient ozone in open-top field chambers near Fresno, CA. Chronic exposure to ambient ozone reduced net carbon dioxide assimilation rates an average of 9% through the season when compared to the filtered-air treatment. The initial slope of a carboxylation efficiency curve was less for the ambient ozone treatment compared to the filtered-air treatment. Individual leaves were exposed to ozone concentrations of 200, 400, or 600 ppb for 5 to 10 hours. No visual ozone damage was found. Exposure of leaves to 200 ppb ozone for 5 hours had no effect on photosynthesis. Photosynthesis was reduced approximately 50 to 80% respectively after 5 hours of exposure to 400 and 600 ppb ozone compared to the controls. There were no significant differences in vine-growth parameters, bud fruitfulness or yield between vines exposed to either filtered or ambient air. Net carbon dioxide assimilation rates for five of six potted grape cultivars exposed to 1.5 times ambient ozone concentrations were substantially less than for those grown in the charcoal-filtered air. The cultivar 'Barbera' had greater rates of photosynthesis at the higher ozone concentration.

3446 (PB–89-222715/XAB) **Effects of acid fog and ozone on conifers. Final report.** Bytnerowicz, A.; Olszyk, D.M.; Takemoto, B.K.; McCool, P.M.; Musselman, R.C. California Univ., Riverside, CA (USA). Statewide Air Pollution Research Center. May 1989. 162p. Available from NTIS, PC A08/MF A01.

This study evaluated the effects of acidic fog (pH 2.0, 3.0, or 4.0) on the physiological, biochemical, and growth responses of two coniferous tree species (Pinus ponderosa and Abies concolor), and determined if exposure to acidic fog predisposed the tree seedlings to the phytotoxic effects of ozone (O_3). Results provide evidence that the growth and metabolic responses of two coniferous tree species could be altered by multiple applications of acidic fog, and by exposure to ambient O_3. In general, the alterations were slight to modest, which may be attributed to the low degree of stress severity, and the slow rate of tree growth. The findings indicate that exposure to acidic fog followed by O_3 does not cause detectable changes in conifer seedling growth within a single-growing season. Nevertheless, it is clear that acidic fog and O_3 cause temporal alterations in seedling physiology and biochemistry.

3447 (PB–89-222723/XAB) **Pilot investigation of indoor-outdoor and personal PM10 (thoracic) and associated ionic compounds and mutagenic activity. Final report, February 1987-April 1989.** Colome, S.D.; Kado, N.Y.; Kleinman, M.; Jaques, P. California Univ., Irvine, CA (USA). Public Policy Research Organization. 27 Apr 1989. 126p. Available from NTIS, PC A07/MF A01.

A major objective of the pilot study was to evaluate methods of measuring indoor and personal exposures to PM10. Other objectives were to examine the feasibility of measuring particle characteristics (other than mass) that may be useful in relating exposures to PM10 to health effects. The investigators tested several types of particle-sampling devices in the homes of eight asthmatic subjects who resided in Orange County. The investigators measured particle mass for levels of sulfate/nitrate ions and the mutagenicity of particle extracts. The pilot study demonstrated successfully the use of certain portable sampling devices to measure PM10 exposure and showed that it is feasible to measure levels of ionic species and mutagenic activity in particle samples obtained with these devices. The results of the study can be applied in the design of larger studies of similar nature.

3448 (PB–89-223341/XAB) **Indoor air quality: Selected references.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). May 1989. 61p. Available from NTIS, PC A04/MF A01.

Also available from Supt. of Docs.

This document was compiled in response to an increasing number of requests for information about indoor air quality, including sick-building syndrome. Included in the publication are the NIOSH Congressional testimony presented before the Subcommittee on Energy Development and Applications; two articles describing the results of NIOSH research and findings on indoor air-quality problems; NIOSH guidance on conducting indoor-air-quality investigations; and a description of the NIOSH health-hazard evaluation program, which can provide NIOSH assistance in evaluating indoor-air-quality problems.

3449 (PB–89-223721/XAB) **Integration of fluid modeling with complex-terrain field studies and model-development efforts.** Snyder, W.H. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab. 22 Feb 1988. 6p. (EPA–600/D-89/036). Available from NTIS, PC A02/MF A01.

EPA's Complex Terrain Model Development Program (CTMDP) was designed to develop reliable atmospheric dispersion models applicable to large pollutant sources located in complex terrain. The primary emphasis was on plume impaction on nearby hills during nighttime stable conditions. EPA's Fluid Modeling Facility (FMF) interacted closely with the model developers participating in the CTMDP and provided support in various ways through the conduct of a wide range of laboratory studies. Work at the FMF prior to the inception of the program provided the basic framework for the model, the dividing-streamline concept, and the focal point around which the field program was designed. At the beginning of the program, the FMF provided direct support as an aid to planning the details and strategies of the field experiments and testing the limits of applicability of the dividing-streamline concept. Later work included exercises of filling in the gaps in the field data, furthering the understanding of the physical mechanisms important to plume impaction in complex terrain and in stably stratified flows in general, testing various modeling assumptions, providing data for calibration of various modeling parameters, and testing the ability of the laboratory models to simulate full-scale conditions.

3450 (PB–89-223960/XAB) **Air toxics control situation room. Report for July 1988-March 1989.** Ponder, W.H.; Nunez, C.M. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1989. 22p. (EPA–600/D-89/088). Available from NTIS, PC A03/MF A01.

This paper describes one component of the Environmental Protection Agency's (EPA's) efforts to assist state and local environmental agencies and its own regional offices in response to their increased responsibilities for planning, evaluating, and approving control approaches for reducing emissions of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). This component is EPA's air toxics control 'situation room'. This is a complex and difficult job, and EPA's guidance and assistance are often sought. Hundreds of sources emit thousands of ozone-producing and toxic pollutants in the U.S. A major concern is the possibility that some of these compounds may cause cancer. In addition, these toxic air pollutants damage materials and cause crop/forest losses. Thus, state and local environmental officials must also assume responsibility for protecting people and the environment from the effects of these pollutants.

3451 (PB–89-224463/XAB) **Evaluation of airborne-asbestos concentrations before and during an O and M (operations and maintenance) activity: A case study.** Kominsky, J.; Freyburg, R. PEI Associates, Inc., Cincinnati, OH (USA). Aug 1989. 34p. Available from NTIS, PC A03/MF A01.

The current lack of information regarding the impact of O&M activities on the potential for asbestos exposure to building staff and occupants prompted this study. This report presents a statistical evaluation of airborne-asbestos data collected before and during an O&M activity involving removal of thermal surface insulation from a feedwater preheater tank in a boiler room. It also presents a comparison of transmission electron microscopy (TEM) analysis on 0.4 micrometer-pore-size polycarbonate and TEM analysis on 0.8 micrometer-pore-size mixed cellulose ester membrane filters. Containment barriers should be designed and maintained for effective prevention of significant increases in airborne asbestos concentrations in the areas adjacent to an O&M activity.

3452 (PB–89-224471/XAB) **Source characterization and control technology assessment of methylene chloride emissions from Eastman Kodak Company, Rochester, NY. Final report, July 1988-April 1989.** Walata, S.A.; Rehm, R.M. Alliance Technologies Corp., Chapel Hill, NC (USA). Jul 1989. 104p. Available from NTIS, PC A06/MF A01.

This report gives results of an assessment of potential control technologies for methylene chloride (also known as dichloromethane or DCM) emission sources at Eastman Kodak Company's Kodak Park facility in Rochester, NY. DCM is a solvent used by Kodak in the manufacture of cellulose triacetate film support. Work has involved: a plant visit where major DCM emission sources were inspected, and evaluation of current and potential control technologies for the DCM emission sources. The report contains information gathered during the plant visit to the Kodak Park facility. Included are emission estimates determined by Kodak of all emission points greater than 8000 lb (3600 kg)/yr DCM, as well as a description of each point observed during the visit. Also included are results of an evaluation of control technologies that might be applied to the major emission sources. A cost analysis of different add-on control devices is provided for four of the uncontrolled emission points.

3453 (PB–89-224943/XAB) **Sensitivity of a regional oxidant model to variations in climate parameters. Volume 1 and 2. Final report.** Morris, R.E.; Gery, M.W.; Liu, M.K.; Moore, G.E.; Daley, C. Systems Applications, Inc., San Rafael, CA (USA). Jul 1989. 149p. Available from NTIS, PC A07/MF A01.

In order to investigate the sensitivity of ozone concentrations to future climate variations, a regional oxidant model was applied for future climate scenarios to two regions: one covering central California (San Joaquin Valley, Sierra Nevada mountains and the San Francisco Bay Area) and the other covering the midwestern and southeastern United States. Based on model calculations, the effects of increased temperature on ambient ozone concentrations results in an increase of the area of exceedances of the ozone air-quality standard, a movement of the peak ozone concentration closer to the urban areas, and the resultant increase in the exposure of people to harmful levels of ozone concentrations. The calculations for California indicate that the maximum daily ozone concentrations may increase from 2 to 20% and the number of people exposed to hourly ozone concentrations in excess of the air-quality standard may triple as a result of a temperature increase. Similar, although less-dramatic, results were seen for the midwestern and southeastern applications.

3454 (PB–89-225601/XAB) **Use of micrometeorological parameters in the establishment of a VOC (volatile organic compounds) monitoring network. Technical report (Final).** Thomas, M. Kansas State Biological Survey, Lawrence, KS (USA). 1988. 25p. Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

As part of an ongoing volatile organic compounds (VOC) ambient air sampling network study using whole-air samplers, this report evaluates the uses of meteorological data in a VOC ambient-air-sampling activity. The report determines the minimum requirements, type of, and usage procedures for meteorological instruments and the ways in which synoptic and on-site meteorological data can be integrated into an overall VOC sampling study. The report would be of interest to those persons interested in the procedures necessary to integrate meteorological data into a VOC ambient-air-emission study. Conclusions based on the study indicate that a detailed understanding of synoptic and on-site meteorology is a critical factor in selecting days for a successful VOC ambient-air-sampling test. Several minimum meteorological instrumentation requirements are needed, one of which is a tripod-based, portable station with a self-contained power source. Real-time viewing and electronic-data logging of the wind speed and direction, as well as temperature and relative humidity, will allow the definition and verification of the sampling-network centerline.

3455 (PB–89-226856/XAB) **Physical characteristics of study plots. Across-a-Lake States acidic-deposition gradient. Forest Service resource bulletin.** Ohmann, L.F.; Grigal, D.F.; Brovold, S. Forest Service, St. Paul, MN (USA). North Central Forest Experiment Station. 1989. 53p. (FSRB-NC–110). Available from NTIS, PC A04/MF A01.

Some people in the United States are concerned that atmospheric pollutants may be affecting the health of the Nation's forests (Barnard 1986). In response to that concern, the authors began research on the relations between forest conditions and atmospheric deposition across the Great Lakes region in 1985. The research consisted of a series of studies to describe: (1) the relations between sulfate (SO_4) deposition in precipitation and soil and tree woody-tissue chemistry; and (2) the interaction among wet deposition, soil, tree woody-tissue chemistry, climate, and tree and plot growth (Ohmann et al. 1987, 1988; Holdaway 1988).

3456 (PB–89-227847/XAB) **Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey.** Caplan, P.E.; Valiante, D.; Cooper, T.C.; Crouch, K.G.; Gideon, J.A. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jun 1989. 81p. (ECTB–171-11B). Available from NTIS, PC A05/MF A01.

An in-depth survey of exposure to silica dust at the Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey was conducted as a part of the Sentinel Event Notification System for Occupational Risks (SENSOR) cooperative effort. The facility manufactured vitreous china products, including toilet bowls and lavatories. Personal and area atmospheric sampling showed that personal exposure to respirable crystalline silica dust ranged from 0.12 to 0.18 mg/m^3 with at least half the samples exceeding the NIOSH recommended exposure limit of 0.05 mg/m^3 for crystalline silica. The workers in the Slip House suffered the highest exposures, where area concentrations averaged 0.38 mg/m^3. Of the other three areas, casting, glaze spraying, and glaze preparation, the highest personal exposures were in the glaze-spraying areas where 67% of the personal samples exceeded the OSHA permissible exposure limits for respirable dust. Ergonomic evaluations were conducted to determine lifting hazards at several workstations. The authors conclude that there were excessive exposures to respirable silica dust and respirable dust. There was also a high risk of lost time in injuries from manual handling of heavy loads. Improvements should be made in the design and maintenance of ventilation control systems, work stations, and work practices.

3457 (PB–89-228720/XAB) **Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio.** Montopoli, M.; Seligman, P.; O'Brien, D.; Zaebst, D. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Mar 1989. 26p. (HETA–88-224-1951). Available from NTIS, PC A03/MF A01.

An investigation was made of possible hazardous working conditions at the Orrville Bronze and Aluminum Company, Orrville, Ohio. Medical screening at the site had recently discovered a worker with a blood lead level in excess of 100 micrograms/deciliter (microg/dl) and seven workers with blood lead levels in excess of 40 microg/dl. The facility was a nonferrous foundry specializing in small- to medium-sized bronze, brass, and copper castings. Lead concentrations in six personal breathing-zone samples ranged from 38 to 520 micrograms/cubic meter (microg/m^3). Airborne copper levels ranged from 26 to 2601 microg/m^3. Airborne zinc concentrations ranged from 291 to 3165 microg/m^3. Three of 18 workers had blood lead levels in excess of 60 microg/m^3, the OSHA level which requires immediate medical removal protection. The report concludes that lead and copper exposures represented a serious health hazard to workers. Measures to reduce exposures, including engineering controls, work practices, and housekeeping are recommended.

3458 (PB–89-230247/XAB) **Health-hazard evaluation report HETA 87-109-1950, North Riverside Fire Department, North Riverside, Illinois.** Zey, J.N.; Richardson, F. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Mar 1989. 24p. (HETA–87-109-1950). Available from NTIS, PC A03/MF A01.

An assessment was made of the toxicity of smoke clouds produced by a zinc chloride smoke-generating device used in training exercises at the Fire Training Facility of the North Riverside Fire Department, North Riverside, Illinois. Analysis indicated that the smoke contained hydrochloric acid, zinc compounds, and several chlorinated hydrocarbons. Evaluations were made during two separate training exercises. Hydrochloric-acid concentrations ranged from trace amounts to 44 mg/m^3, exceeding the OSHA recommended ceiling level criteria of 7 mg/m^3. Zinc-chloride concentrations ranged from 63 to 172 mg/m^3; the limit was 2 mg/m^3. Zinc-chloride concentrations ranged from up to 62 mg/m^3. The amount of smoke generated for the exercise significantly surpassed that recommended by the manufacturer. Five and six participants in the two exercises experienced symptoms including breathing difficulty, joint pain, fever and chills, and general fatigue. These individuals were not wearing a respirator or had removed it as a part of the drill. The report concludes that the dense clouds created by the smoke-generating devices should be considered hazardous to individuals without respiratory protection and recommends the use of a self-contained breathing apparatus during training exercises.

3459 (PB–89-230254/XAB) **Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados.** Crandall, M.S.; Fleeger, A.K. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Mar 1989. 39p. (HETA–88-372-1953). Available from NTIS, PC A03/MF A01.

In response to a request from the Pan American Health Organization to investigate the potential for exposure to asbestos among workers and the general public on Barbados, NIOSH investigators visited five sites preselected for evaluation. These included the Treasury Building, Queen Elizabeth Hospital, St. Leonard's Secondary School, a sugar factory and a vehicle repair shop. At all sites, except the vehicle maintenance shop, asbestos containing materials were identified by bulk sample analysis. Both amosite and chrysotile asbestos fibers were found. All but one of the settled dust samples were negative, suggesting good housekeeping procedures were in place. General air concentrations of fibers were low at the time of the visits. The authors conclude that asbestos constituted a hazard since it was widely used and highly accessible to workers and the general public in Barbados. Specific measures to control asbestos are recommended.

3460 (PB–89-233464/XAB) **Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989.** Clark, T.L.; Dennis, R.L.; Seilkop, S.K. Analytical Sciences, Inc., Research Triangle Park, NC (USA). Jun 1989. 42p. Available from NTIS, PC A03/MF A01.

During the summer of 1987, annual amounts of sulfur dry deposition were first estimated for more than 7,000 lakes in the northeastern United States. These estimates, heretofore termed interim estimates since they were expected to be superseded in the near future, were derived from predictions of the Regional Acid Deposition Model (RADM) adjusted using the empirical data from two monitoring networks. In this report the authors compare the dry-deposition predictions from the three models (RADM, RELMAP and ASTRAP) to the available empirically-derived estimates to ascertain which of these models most accurately represents the spatial pattern of sulfur dry deposition. Using one of these models in conjunction with the available data, they then recommend systematic revisions to the interim estimates. The uncertainty and bias in these revised estimates are characterized relative to interannual variability in the empirically-estimated amounts of sulfur dry deposition, and distance of sites from the emission-source regions.

3461 (PB–89-863856/XAB) **Asbestos and silicate pollution in the work place. January 1978-July 1989 (Citations from Pollution Abstracts). Report for January 1978-July 1989.** National Technical Information Service, Springfield, VA (USA). Aug 1989. 64p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning occupational exposure to asbestos and silicate fibers in the work place. Correlations are cited between occupational exposure, carcinogenesis, and mortality. Included are surveys of occupational exposure of shipyard and dockyard workers; mechanics; miners; insulation workers; sheet metal workers; millers; and workers in pottery mills, foundries, chemical industry and power stations. Surveys and health examinations are reported for workers and family members whose exposure results from the worker. Asbestos and silicate pollution exposure standards, and hazard control technology are cited. References to nonoccupational asbestos and silicate pollution are excluded and can be found in other published bibliographies. (Contains 132 citations fully indexed and including a title list.)

3462 (PNL–7163) **International aspects of restrictions of ozone-depleting substances.** McDonald, S.C. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 54p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90001813. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report summarizes international efforts to protect stratospheric ozone. Also included in this report is a discussion of activities in other countries to meet restrictions in the production

and use of ozone-depleting substances. Finally, there is a brief presentation of trade and international competitiveness issues relating to the transition to alternatives for the regulated chlorofluorocarbons (CFCs) and halons. The stratosphere knows no international borders. Just as the impact of reduced stratospheric ozone will be felt internationally, so protection of the ozone layer is properly an international effort. Unilateral action, even by a country that produces and used large quantities of ozone-depleting substances, will not remedy the problem of ozone depletion if other countries do not follow suit. 32 refs., 7 tabs.

3463 (PNL–7166) **Evaluate and characterize mechanisms controlling transport, fate, and effects of army smokes in the aerosol wind tunnel: Transport, transformations, fate, and terrestrial ecological effects of hexachloroethane obscurant smokes: Final report.** Cataldo, D.A.; Ligotke, M.W.; Bolton, H. Jr.; Fellows, R.J.; Van Voris, P.; McVeety, B.D.; Li, Shu-mei W.; McFadden, K.M. Pacific Northwest Lab., Richland, WA (USA). 1 Sep 1989. 195p. Sponsored by U.S. Department of Defense; U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90002923. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The terrestrial transport, chemical fate, and ecological effects of hexachloroethane (HC) smoke were evaluated under controlled wind tunnel conditions. The primary objectives of this research program are to characterize and assess the impacts of smoke and obscurants on: (1) natural vegetation characteristic of US Army training sites in the United States; (2) physical and chemical properties of soils representative of these training sites; and (3) soil microbiological and invertebrate communities. Impacts and dose/responses were evaluated based on exposure scenarios, including exposure duration, exposure rate, and sequential cumulative dosing. Key to understanding the environmental impacts of HC smoke/obscurants is establishing the importance of environmental parameters such as relative humidity and wind speed on airborne aerosol characteristics and deposition to receptor surfaces. Direct and indirect biotic effects were evaluated using five plant species and two soil types. HC aerosols were generated in a controlled atmosphere wind tunnel by combustion of hexachloroethane mixtures prepared to simulate normal pot burn rates and conditions. The aerosol was characterized and used to expose plant, soil, and other test systems. Particle sizes of airborne HC ranged from 1.3 to 2.1 μm mass median aerodynamic diameter (MMAD), and particle size was affected by relative humidity over a range of 20% to 85%. Air concentrations employed ranged from 130 to 680 mg/m^3, depending on exposure scenario. Chlorocarbon concentrations within smokes, deposition rates for plant and soil surfaces, and persistence were determined. The fate of principal inorganic species (Zn, Al, and Cl) in a range of soils was assessed.

3464 (PNL-SA–17385) **Air quality monitoring at toxic waste sites: A Hanford perspective.** Laws, G.L.; Glantz, C.S. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891053–11: 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?, Richland, WA (USA), 16-19 Oct 1989). Order Number DE90002727. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Air quality monitoring is being conducted as part of remedial investigation activities at waste sites in the 1100-EM-1 Operating Unit at the US Department of Energy's Hanford Site. Sampling is being conducted for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) (including pesticides and PCBs), metals, and asbestos. The monitoring program is being conducted in three phases: before, during, and after intrusive remedial investigation activities. At each waste site, battery-powered monitoring equipment is positioned at one location upwind of the site (to measure background concentrations of pollutants) and typically at two locations downwind of the site. Control samples are used to identify sample contamination that may occur during handling or analysis. All samples are analyzed using methods approved by the US Environmental Protection Agency. The results from the first phase of sampling have been assessed and are being used to upgrade sampling and laboratory analysis procedures. 5 refs.

3465 (RFP–4376) **Development of a hazardous materials dispersion modeling capability with application to ambient air monitoring network design: Project plan.** Hodgin, C.R. Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. 7 Jul 1989. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP03533. Order Number DE90002286. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Rocky Flats Plant is applying the Terrain Responsive Atmospheric Code (TRAC) for developing a monitoring network design for airborne hazardous materials around the Rocky Flats site. This project is being implemented in response to a recent agreement between the State of Colorado and the Department of Energy. The Hazardous Materials version of TRAC (and resulting monitor siting plan) will be developed in a series of 63 tasks which will involve modification of the TRAC model to account for continuous emissions, source configuration and hazardous material. After testing these modifications, a long-term archival meteorological data base will be implemented and used to produce the monitoring design. 2 figs.

3466 (STEV-FBT–89-25) **Emission of nitrogen oxide from a circulating fluidized bed boiler - the influence of design parameters.** Aamand, L.E.; Leckner, B. Statens Energiverk, Stockholm (Sweden). 1989. 9p. (CONF-880302–1: 2. International conference on circulating fluidized bed boilers, Compiegne (France), 14-18 Mar 1988). Order Number DE90719435. Available from NTIS (US Sales Only), PC A02/MF A01.

In a circulating bed with limestone addition, the oxidation of nitrogen containing volatiles causes an increased emission of nitrogen oxide. This effect can be mitigated by avoiding excess addition of limestone in relation to the sulphur content of the fuel or by arranging the air supply in a suitable way, thus decreasing the oxidation of ammonia.

3467 (SVF–336) **Experiences of DOAS technique for flue gas measurements.** Vessely, V.; Nyquist, G.; Jansson, C. Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden); National Swedish Environmental Protection Board, Solna (Sweden). May 1989. 82p. (In Swedish). (SNV–3609). Order Number DE90719408. Available from NTIS (US Sales Only), PC A05/MF A01.

The DOAS (Differential Optical Absorption Spectroscopy) technique is an optical in situ method for determination of certain gaseous pollutants. Field tests of such a system for emission measurements were performed at three different combustion plants (fuel: pulverized coal, oil and, refuse). The measured flue gas pollutants were SO_2, NO, NO_2 and Hg. Simultaneously, continuous measurements of SO_2, NO and NO_x with a stack gas diluting system were carried out.

3468 (UCID–21682) **Beryllium dispersion near explosive firing tables: A comparison of computed and observed results.** Shinn, J.H.; Cederwall, R.T.; Lamson, K.C.; Mitchell, C.S. Lawrence Livermore National Lab., CA (USA). Jul 1989. 57p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90002635. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

We have demonstrated that evaluation of vertical atmospheric Be profiles, extensive deposition samples, a few strategically located air concentration measuring devices, and ambient meteorological conditions can be used to characterize the high-explosives tests at Site 300. Our application of modeling simulation using the detailed description of Be particle-size and air concentrations in the stem and cap cloud formed during a detonation has resulted in a high level of physical realism and objectivity in the assessment of downwind Be deposition and short-term elevated air concentrations. 46 refs., 18 figs., 3 tabs.

3469 (UCRL–101996) **In situ optical measurements of hydrofluoric acid aerosols.** Holve, D.J.; Harvill, T.L.; Schatz, K.W.; Koopman, R.P. Lawrence Livermore National Lab., CA (USA). Sep 1989. 36p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908168–2: AIChE meeting on controls of accidental releases of hazardous gases, Philadelphia, PA (USA), Aug 1989). Order Number DE90002108. Available from NTIS, PC A03/MF A01 - OSTI.

HF aerosol measurements were obtained in a specially developed flow chamber with a cross-section of 8 x 16 feet, and approximately 140 feet long. The primary objective was to determine the extent of HF aerosol mist formation in a potential accidental release of HF. A newly developed in situ optical instrument (PCSV-P) was used to obtain on-line measurements of the aerosol. A total of 86 usable aerosol data sets were obtained during the test period. As many as 10 data sets were acquired for an 11 minute duration HF release. Briefly summarizing the results, the PCSV-P measured predominately submicron aerosols at the exit of the sharp-edged orifice. The aerosol then grew to larger particles at the outlet of the flow chamber. This result points to the formation of an aerosol through vaporization-condensation as opposed to a conventional shear spray. Temperature, humidity, release pressure, radial position in the plume, and type of acid did not appear to have an significant effect in the measured size distributions for the range of conditions investigated. 7 refs., 23 figs., 2 tabs.

3470 **National report for the Netherlands. The IEA energy technology systems analysis project (ETSAP)/Annex 3.** Kram, T.; Okken, P.A. 49p. Netherlands Energy Research Foundation ECN, Petten (NL) (Oct 1989).

During the current phase of ETSAP, several national energy/environment and technology assessment studies have been carried out, using the MARKAL model as the main tool for integral analysis. The work was sponsored by the Ministry of Economic Affairs and by NOVEM, the Netherlands Agency for Energy and Environmental R, D and D Management. An overview is given of the main results of these studies, which were also presented at earlier ETSAP workshops and joint meetings with other international projects. More detail can be found in the publications (1-7) in the list of references. The studies initially concentrated upon the emission of acidifying agents from the energy system (SO_2 and NO_x) and ways to reduce these emissions. From 1988 the emphasis shifted towards the greenhouse effect, in particular the emission of CO_2 from burning fuels. 24 figs., 13 refs., 6 tabs., 2 apps.

3471 **Seasonal climatic changes induced by doubled CO_2 as simulated by the OSU atmospheric GCM/mixed-layer ocean model.** Schlesinger, M.E. (Department of Atmospheric Sciences and Climatic Research Institute, Oregon State University, Corvallis, Oregon (US)); Zhao Zong-ci. *Journal of Climate (USA)*, 2(5): 459-495 (May 1989).

The OSU global atmospheric general circulation model (AGCM) has been coupled to a 60-m deep mixed-layer ocean model to simulate the equilibrium seasonal climatic changes induced by a doubling of the CO_2 concentration. Simulations with CO_2 concentrations of 326 ppmv ($1\times CO_2$) and 652 ppmv ($2\times CO_2$) were performed using an accelerated integration procedure for 45 solar cycles followed by the normal unaccelerated integration procedure for 24 and 16 solar cycles (years), respectively. Averages were then obtained over the last 10 yr of each simulation and were analyzed in terms of the annual-mean climate and the annual cycle of climate, the latter defined as the departure of the monthly or seasonal mean from the corresponding annual mean.

3472 **An acid rain study in the Washington, D.C. area.** Patrinos, A.A.N. (Atmospheric Sciences Division, Brookhaven National Laboratory, Upton, New York (US)); Leach, M.J.; Brown, R.M.; Tanner, R.L.; Binkowski, F.S. *Journal of Applied Meteorology (USA)*, 28(9): 948-968 (Sep 1989). DOE Contract AC02-76CH00016.

A field study in the Washington, D.C. area explored the impact of urban emissions and mesoscale meteorology on precipitation chemistry. The study was a follow-up to an earlier, considerably more industrialized, study in the Philadelphia area; emissions along the Delaware Valley were found to affect the deposition of nitrate and sulfate on the urban mesoscale. The Washington studies were designed to complement and enhance the earlier study with an expanded sampling domain, sequential precipitation sampling and airborne measurements. Four storms were sampled successfully between October 1986 and April 1987. Results appear to confirm the conclusions of the Philadelphia study, although the upwind–downwind contrast in nitrate and sulfate deposition is not as pronounced. This difference is attributed to the area's widely distributed emission patterns and to the prevailing theories regarding the production of nitric acid and sulfric acid on the relevant time and space scales. The importance of mesoscale meteorology and hydrogen peroxide availability is highlighted in at least two of the sampled storms.

3473 **Concentration profiles from lidar measurements in the presence of multiple scattering: the two-stream approximation.** Ayoubi, I.S. (Texas A&M University, Departments of Mathematics, and Nuclear Engineering, College Station, Texas 77843-3133 (US)); Nelson, P. *Applied Optics (USA)*, 28(19): 4133-4140 (1 Oct 1989).

We consider the problem of obtaining, from monostatic lidar measurements, the concentration profile for a medium of known scattering properties. Invariant imbedding methods are applied to the two-stream approximation to the radiative transfer equation in one dimension, to obtain a nonlinear integrodifferential equation that takes account of multiple scattering events, and whose solution yields the desired profile. A discretization scheme for this equation is presented, along with results from using it to solve two sample problems. The stability of this inversion scheme in the face of noisy signals is also explored.

5003 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 2193, 2230, 2539, 2540, 2669, 2692, 2804, 3056, 3503, 3504, 3507, 3516

3474 (AD-A–210518/7/XAB) **Assessment of global atmospheric effects of a major nuclear conflict. Final report, 1 February 1984-31 May 1987.** Muench, H.S.; Banta, R.M.; Brenner, S.; Chisholm, D.A. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 10 May 1988. 90p. (AFGL-TR–88-0217). Available from NTIS, PC A05/MF A01.

In 1983, evidence started emerging that a major nuclear conflict could result in substantial weather changes over vast regions of the globe, including severe surface cooling over the continents. Refined projections of the density and horizontal extent of persistent layers of smoke (soot) led to revised estimates of the magnitude of the postulated surface cooling. The impact to the post-attack environment (even given the range of uncertainty due to the assumptions made) implied heretofore unrecognized consequences to the quality of life in vast regions and to effective national defense planning and execution. Subsequent studies sought to reduce the uncertainties in the calculations, by clarifying some assumptions and replacing others with more complete and newer scientific data. They have resulted today in assessments which, while indicating smaller surface-temperature effects than previous studies for a given amount of soot, do document with increased scientific certainty that secondary consequences of a nuclear exchange would complicate the quality of life of survivors for extended periods and over areas well removed from the geographic region directly involved in the exchange. The resulting period of abnormal optical path lengths due to smoke (soot) would also complicate national defense contingencies.

3475 (CNEN-NE–1.22) **Programs of meteorology in support of nuclear power plants.** Coutinho, M. de F.F.; Miyamoto, A.; Nicoli, D. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Normas e Especificacoes. Jul 1989. 31p. (In Portuguese). (DNE–41). Available from Centro de Informacoes Nucleares of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

The objective of this norm is to establish minimum requirements for that the programs of meteorology in support of nuclear power plants, can be adequate to the obtention and application of feasibility information and data for emergency situations.

3476 (IPPJ-DT–146) **Measurements of environmental radiations and radioactivities in Toki, 5.** Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. 113p. (In Japanese). Order Number DE90719715. Available from NTIS (US Sales Only), PC A06/MF A01.

The booklet carries six reports. The first report, titled 'Measurements of Environmental Radiation in 1986 and 1987', consists of two parts: 'A report of TLD Measurement of Environmental Radiations in the Toki Area' and 'Measurement of Environmental Radiations at the Higashiyama and Toki Sites'. Measurements of environmental radiations made at various points throughout the area are presented. The second report, titled 'Environmental Tritium

Measurements in Toki Area', presents measurements of environmental tritium made at various points in the Toki area. The third study addresses the 'Radioactivity in Rain Associated with Chernobyl Nuclear Reactor Accident'. Rain is collected on the roof of the Institute of Plasma Physics, and gamma ray measurements are made with a germanium detector. The concentrations of radioactive fallout substances are analyzed. Then, the relations of the concentrations with the spatial dose rate is investigated. The fourth work deals with the 'Concept and Mutual Relation of Radiation-Related Quantities'. The fifth report outlines a 'System for Radiation Monitoring around Accelerator'. The sixth report describes some features of the National Lab. for High Energy Physics (KEK). (N.K.).

3477 (IPPJ-DT–147) **Measurements of environmental radiations and radioactivities in Toki, 6.** Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. 51p. (In Japanese). Order Number DE90719714. Available from NTIS (US Sales Only), PC A04/MF A01.

The booklet carries five reports. The first one, titled 'A Study on Nuclear Fusion Environmental Safety in the Nagoya University, Institute of plasma physics', deals with the design and development of a radiation monitoring system and a tritium monitoring system. The second work, titled 'Measurement of Environmental Radiations', consists of two parts: 'A report on TLD Measurement of Environmental Radiations in the Toki Area' and 'TLD Measurement in Toki Area (1982-1988)'. Measurements of environmental radiations made at various points throughout the area are presented. The third study addresses 'Radioactivity in Rain Associated with Chernobyl Nuclear Reactor Accident'. Rain is collected on the roof of the Institute of Plasma Physics, and gamma ray measurements are made with a germanium detector. The concentrations of radioactive fallout substances are analyzed. Then, the relations of the concentrations with the spatial dose rate is investigated. The fourth report, titled 'Measurements of Environmental Tritium Concentration in the Toki Area', deals with measurements made at various points throughout the area are listed. The fifth and last report briefly outlines some features of the Kyoto University Plasma Physics Laboratory and the Osaka University Institute of Laser Engineering. (N.K.).

3478 (IVL-B–912) **Monitoring of air pollution in the southern counties.** Westling, O.; Loevblad, G. Swedish Environmental Research Inst., Stockholm (Sweden). Nov 1988. 37p. (In Swedish). Order Number DE90719421. Available from NTIS (US Sales Only), PC A03/MF A01.

The amount of atmospheric deposition and its influence on forest land are monitored in Southern Sweden. Deposition, soil water, soil chemistry and content of heavy metals in mosses are regularly controlled since 1984. Results from this survey indicate that load of sulphur varies from 9 to 35 kg per hectare and year. This is to be compared with 5 kg, regarded as critical load for sulphur. Nitrogen deposition does not exceed the critical load. Soil acidification and leakage of aluminium occurs in all counties. Large amount of nitrogen in soil waters are observed in coastal areas. (authors).

3479 (JAERI-M–89-082) **Verification study of a three-dimensional local scale atmospheric model PHYSIC at seacoast region.** Yamazawa, Hiromi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 48p. Order Number DE90719560. Available from NTIS (US Sales Only), PC A03/MF A01.

The performance of a three-dimensional numerical atmospheric model (PHYSIC) was examined over a seacoast region with the data observed during the field tracer experiment at the Tokai site. The main frame of PHYSIC is made up of the momentum equations with the hydrostatic and Boussinesq approximation, the second-order turbulence closure model level 2.5 by Yamada and other basic equations of physical processes in the atmosphere. A terrain following Z_* coordinate system is used. The present model successfully predicts the temporal change of wind field within twenty hours from the evening to the next noon. The occurrence and structure of sea breeze are simulated satisfactorily. The model performance concerning the eddy diffusivities is thought to be reasonable, although the direct comparison between the calculation and observation is restricted to the wind and temperature profiles by the limited observation data. This was supported by an additional calculation with a diagnostic model of turbulence quantities. (author).

3480 (JET-R–89-06) **Model for calculating room air and surface tritium concentrations.** Brereton, S.J.; Gordon, C.W. Commission of the European Communities, Abingdon (UK). JET Joint Undertaking. May 1988. 23p. Order Number DE90608185. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A mathematical model and the resultant analytical solutions for calculation of transient tritium concentrations in room air and in solid surfaces are presented. Although more elaborate models exist for describing the behaviour of tritium released into enclosures, a simpler approach was considered adequate for a preliminary assessment of situations arising at JET. A comparison to experimental data and several cases of interest are also presented. These preliminary checks have confirmed that the basic approach is sound. Further checks and refinement may be required to cover the full range of practical situations. (author).

3481 (KFK–4447) **Uncertainty analyses for the atmospheric dispersion submodule of UFOMOD with emphasis on parameter correlations.** Fischer, F.; Paesler-Sauer, J.; Raicevic, J. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit (PRS). Aug 1989. 131p. Contract CEC BI6/F/128/D. Order Number DE90722280. Available from NTIS (US Sales Only), PC A07/MF A01.

Special emphasis is put on some helpful theoretical investigations concerning: 1. different types of correlation between uncertain model parameters; 2. test procedures to find out the most sensitive uncertain model parameters; 3. the percentage contribution of parameter variations to changes in consequence values. For the mentioned submodule of the new program system UFOMOD version NE 87/1, the most important parameters are stable in their rankings regardless of the underlying distributions (predefined by experts or all uniformly distributed, respectively). For the less important parameters the values of the sensitivity measures (PRCC values) vary for predefined or uniform distributions, respectively. But even then in most cases the ranking is the same. Increasing sample sizes (n = 80, 100) lead to more precision in sensitivity calculations, i.e. lead to a decrease of the critical 'white noise level' (garbage level) of absolute PRCC values. R^2-values (coefficients of determination) in conjunction with the corresponding PRCC values visualize the percentage contribution of each uncertain model parameter (or groups of uncertain parameters) to uncertainty in consequences. This is important, because a large absolute PRCC value is not in every case an indication for a considerable amount of responsibility for uncertainty in consequences. The restriction to pure model parameters and revised parameter variations in the atmospheric dispersion and deposition submodule of the new UFOMOD code system lead to significantly smaller uncertainty bands than for the old UFOMOD/B3 code. Variations in deposition velocities and the mixing height parameters play the most important role for uncertainties in the activity concentration values. (orig./HP).

3482 (LA-UR–89-3431) **The continuing saga of alpha CAM [continuous air monitor] development at Los Alamos.** Nelson, D.C.; Wolf, M.A.; McAtee, J.L. III. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891087–9: IEEE nuclear science symposium and exhibits, San Francisco, CA (USA), 25-27 Oct 1989). Order Number DE90002382. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Monitoring requirements for airborne plutonium are becoming increasingly stringent as regulations require progressively lower limits of detection. The current requirement of 8 DAC-hours reflects the limitations of today's technology for workplace monitoring. Simultaneously, closed-ventilation systems and massive concrete buildings are concentrating radon and its daughter products. The daughter products produce a spectrum that degrades the ability of a continuous air monitor (CAM) to make accurate low-level determinations of plutonium. Los Alamos has been working on improved methods for detecting airborne alpha emitters in the presence of radon daughter products for the last 2 years. These efforts were recently coordinated into a program to examine all facets of CAM operation including aerosol collection, detection, signal processing, computation, alarming, communications, and finally, instrument cost. 4 refs., 2 figs.

3483 (ORNL/TM–11329) **ISIS: An Interactive System for Instruction and Sampling.** Buckley, B.B.; Fields, D.E. Oak Ridge National Lab., TN (USA). Nov 1989. 31p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002507. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This computer interactive system for instruction and sampling is designed to introduce sampling of a contaminated site or field sampling to persons new to the activity. Through a series of questions, the program determines the extent of field sampling experience the novice has previously obtained. Based on answers given to these questions, the program provides the novice information about what should be done to prepare for and initiate correct field sampling procedures. Information on the types of radioactive emissions (alpha, beta, and gamma) for which the novice will be searching is also available. Detailed instructions are presented by the program for the detection and measurements of alpha, beta, and gamma radiation. Procedures for operating the alpha counter, Geiger-Mueller counter, and scintillation counter are presented in clear and precise steps so that very few errors, if any, are expected. 4 refs.

3484 (PB–89-205975/XAB) **Application of radon reduction methods (revised).** Mosley, R.B.; Henschel, D.B. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. Apr 1989. 111p. (EPA–625/5-88/024). Available from NTIS, PC A06/MF A01.

Also available from Supt. of Docs. See also PB–89-122162.

The purpose of the manual is to provide guidance in diagnosing radon problems in houses as well as in selecting, designing, and installing radon reduction systems. The organization of the manual is designed to guide the user through decision making by stages to the point of operating and maintaining a successful radon reduction system. Note that advice is provided on choosing a professional mitigator to recommend and/or install a mitigation system. The present document focuses on actions that can be taken to reduce the risks associated with indoor radon exposure once a problem has been recognized.

3485 (PB–89-219984/XAB) **Testing of indoor radon-reduction techniques in central Ohio houses: Phase 1 (Winter 1987-1988). Report for October 1987-August 1988 (Final).** Findlay, W.O.; Robertson, A.; Scott, A.G. Acres International Corp., Amherst, NY (USA). Jul 1989. 316p. Available from NTIS, PC A14/MF A01.

See also PB–87-188124.

The U.S. Environmental Protection Agency (EPA) has a program to demonstrate practical, cost-effective methods to reduce indoor radon concentrations in housing to 150 Bq/cu m (4 pCi/L) or less. The complete program will evaluate the full range of radon-reduction methods, i.e., house ventilation, sealing of entry routes, soil ventilation, radon removal from water, and air cleaning in the full range of housing substructure types and building styles, and geological conditions across the continental United States. The program described in the report demonstrated certain radon-reduction methods in housing and geology typical of southern Ohio in particular, and the central Great Plains States in general. The testing of radon-mitigation systems in Ohio houses is envisioned as taking place in two phases. The report describes Phase 1, which was carried out in 16 existing houses in the Dayton area during the 1987-1988 heating season.

3486 (PB–89-224000/XAB) **Environmental Radiation Data: Report 56, October-December 1988. Quarterly report.** Office of Radiation Programs, Washington, DC (USA). Jun 1989. 42p. (EPA–520/5-89/013). Available from NTIS, PC A03/MF A01.

See also PB–89-135958.

Environmental Radiation Data (ERD) contains data from the Environmental Radiation Ambients Monitoring System (ERAMS). Data from similar networks operated by contributing States, Canada, Mexico, and the Pan American Health Organization are reported in the ERD when available. The ERAMS is comprised of nationwide sampling stations that provide air, surface and drinking water and milk samples from which environmental radiation levels are derived. Sampling locations are selected to provide optimal population coverage while functioning to monitor fallout from nuclear devices and other forms of radioactive contamination of the environment. The radiation analyses performed on these samples include gross alpha and gross beta levels, gamma analyses for fission products, and specific analyses for uranium, plutonium, stronium, iodine, radium, krypton, and tritium.

3487 (PB–89-224273/XAB) **Indoor radon and radon-decay product measurement protocols.** Office of Radiation Programs, Washington, DC (USA). Mar 1989. 105p. (EPA–520/1-89/009). Available from NTIS, PC A06/MF A01.

See also PB–89-224265.

The publication updates the Interim EPA Radon Measurement Protocols by providing guidance for using a total of 11 measurement techniques. EPA has extensive laboratory and field experience with seven of the methods: continuous working level and radon monitors, alpha-track detectors, charcoal canisters, RPISUs, and grab techniques. The remaining four methods are interim; EPA has evaluated these techniques in the laboratory and found them to be satisfactory. The protocols provide instrument-specific technological guidance that can be used as the basis for standard operating procedures.

3488 (PNL-SA–17367) **Meteorological monitoring for environmental/dose assessment and emergency response modeling: How much is enough?.** Glantz, C.S. Pacific Northwest Lab., Richland, WA (USA). 1989. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891053–9: 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?, Richland, WA (USA), 16-19 Oct 1989). Order Number DE90002726. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In evaluation the effectiveness and appropriateness of meteorological monitoring programs, managers responsible for planning and operating emergency response or environmental/dose assessment systems must routinely question whether enough meteorological data are being obtained to adequately support system applications. There is no simple answer or cookbook procedure that can be followed in generating an appropriate answer to this question. The answer must be developed through detailed consideration of the intended applications for the data, the capabilities of the models that would use the data, pollutant release characteristics, terrain in the modeling region, the size of the modeling domain, and the distribution of human population in the modeling domain. It is recommended that manager consult meteorologists when assessing these factors; the meteorologist's detailed knowledge of, and experience in, studying atmospheric transport and diffusion should assist the manager in determining the appropriate level of meteorological monitoring. 1 ref.

3489 (UCRL–21212) **Impact of a simulated nuclear winter environment on growth development and productivity of potatoes, winter wheat, pines and soybeans.** Palta, J.P. Lawrence Livermore National Lab., CA (USA). [1988]. 52p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90001145. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Several recent studies predict strong land surface cooling and reduction in solar irradiance following nuclear explosions (Turco et al., 1983; Covey et al., 1984; Thompson et al., 1984). Although there is disagreement among scientists on the extent and the duration of temperature and irradiation decrease, there is a general agreement on the "nuclear winter" hypothesis following nuclear war (Covey, 1985). Agreements between the timing of excessive frost events and volcanic eruptions supports such nuclear winter scenarios (La Marche Jr. and Hirschboek, 1984). More recently Robock (1988) recorded a drop in surface temperatures following the entrapment of smoke from a forest fire in northern California. These measurements also support the nuclear winter hypothesis. The present study was conducted to investigate the impact of a simulated nuclear winter environment on productivity of four plant species. 20 refs., 21 figs., 10 tabs.

3490 **Atmospheric depositional characteristics of Beryllium 7 and Lead 210 along Southeastern Virginia coast.** Todd, J.F. (Department of Oceanography, Old Dominion University, Norfolk,

Virginia (US)); Wong, G.T.F.; Olsen, C.R.; Larsen, I.L. *Journal of Geophysical Research (USA)*, 94(D8): 11106-11116 (20 Aug 1989).

Atmospheric depositional fluxes of ^{7}Be and ^{210}Pb were measured simultaneously in wet-only and bulk deposition over a 29-month period (October 1982 through February 1985) in Norfolk, Virginia (36°53′N, 76°18′W). Total precipitation accumulation during 1983 and 1984 was 134 and 129 cm, respectively, slightly above the normal yearly accumulation. The volume-weighted average concentrations of ^{7}Be in bulk deposition for 1983 and 1984 were 90 and 100 dpm/L, while those for ^{210}Pb were 5.9 and 6.6 dpm/L, respectively. The annual depositional fluxes of ^{7}Be and ^{210}Pb in bulk deposition in 1983 and 1984 were 12.0 and 12.9 dpm/cm^2 (for ^{7}Be) and 0.79 and 0.85 dpm/cm^2 (for ^{210}Pb), respectively. There was a high degree of correlation between ^{7}Be and ^{210}Pb concentrations in wet-only deposition. This was not aniticipated, considering that the sources of these two radionuclides are different. These results suggest that ^{7}Be and ^{210}Pb cannot be used as two independent tracers for materials originating in the stratosphere versus those from the troposphere. Dry depositional fluxes for both radionuclides, estimated from differences in the wet-only and bulk fluxes, were calculated to be a maximum of 12 and 11% of the bulk ^{7}Be and ^{210}Pb fluxes, respectively. On an annual average the washout ratio for ^{7}Be in bulk deposition was 370, while that for ^{210}Pb was 215. The annual average total deposition velocities for ^{7}Be and ^{210}Pb were estimated to be 1.3 and 0.7 cm/s, respectively.

5005 Site Resource and Use Studies

Refer also to citation(s) 3410

5006 Regulations

Refer also to citation(s) 3416, 3470, 3532, 3533

3491 (PB–89-225411/XAB) **BACT/LAER (Best Available Control Technology/Lowest Achievable Emission Rate) Clearinghouse: A compilation of control-technology determinations. Fourth supplement to 1985 edition. Summary tables and appendices A-H.** PEI Associates, Inc., Cincinnati, OH (USA). Jun 1989. 568p. Available from NTIS, PC A24/MF A01.

See also report dated Jul 88, PB–89-109060.

The Clean Air Act as amended in 1977 prescribes several technology-based limitations affecting new or modified air-pollution sources: (1) new source performances standards (NSPS); (2) best available control technology (BACT); and (3) lowest achievable emission rate (LAER). The basic purposes of the BACT/LAER Clearinghouse are to: (1) provide State and local air-pollution-control agencies with current information on case-by-case control technology determinations that are made nationwide and (2) promote communication, cooperation, and sharing of control-technology information among the permitting agencies. The information presented in the compilation was abstracted from preconstruction permits and submitted voluntarily by the State and local air-pollution-control agencies.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

Refer also to citation(s) 3499, 3540

3492 (DOE/SR/14069–2) **Establishment of a viable population of red-cockaded woodpeckers at the Savannah River Site: Progress report, FY 1989.** Allen, D.H. Forest Service, Aiken, SC (USA). Southeastern Forest Experiment Station. 1989. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AI09-85SR14069. Order Number DE90001936. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In 1985 the Southeastern Forest Experiment Station in cooperation with the Department of Energy (DOE), the Savannah River Forest Station (SRFS) and the Savannah River Ecology Laboratory (SREL) initiated a research/management program to restore a viable population of red-cockaded woodpeckers (RCW) to the Savannah River Site (SRS). The program has progresses in two phases. The first phase (1985-1987) focused on stabilizing the declining RCW population at SRS. The second phase (1988-present) has focused on facilitating population expansion. In 1989 we have focused our efforts on development of techniques for excavating new RCW cavities, identification of old-growth stands with the potential of providing new nesting habitat to support population expansion, continued flying squirrel control, continued translocations of RCW's as needed, and monitoring clan composition and reproduction.

3493 (INIS-mf–12013, pp. 162-163) **Geological interpretation of lead isotope ratios in ores from the Aegaean.** Chalkias, S. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Vavelidis, M.; Schmitt-Strecker, S.; Begemann, F. Max-Planck-Institut fuer Kernphsik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Lead isotope analyses from ore deposits of the Aegaean region were carried out under archaeometallurgical aspects. They are of geological interest as well. The lead isotopes point to the crust as the source region of the ore forming solutions. The model ages scatter very largely from Precambrain to negative values, but they concentrate in the alpidic orogenetic period. (orig.).

5102 Chemicals Monitoring and Transport

Refer also to citation(s) 2716, 2717, 2718, 2719, 2720, 2721, 2722, 2723, 2736, 2770, 3455, 3463, 3557, 3752, 3791, 3792

3494 (CONF-8906242–1) **The Hazardous Materials Information Exchange: An electronic bulletin board for the emergency response community.** Seymour, D. Argonne National Lab., IL (USA). [1989]. 3p. Sponsored by U.S. Department of Transportation; U.S. Federal Emergency Management Agency. DOE Contract W-31109-ENG-38. From HAZMAT '89 international conference; Atlantic City, NJ (USA); 13-15 Jun 1989. Order Number DE90002844. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Hazardous Materials Information Exchange (HMIX) is an electronic bulletin board sponsored jointly by the Federal Emergency Management Agency (FEMA) and the Research and Special Programs Administration (RSPA) of the US Department of Transportation (DOT). Its purpose is to serve as an exchange system or "clearinghouse" to provide federal, state, local, and private-sector individuals with a means of sharing timely and valuable information on topics relating to hazardous materials emergencies. The HMIX offers emergency management personnel information on training, private-sector initiatives, conferences, literature, other databases, legislation, regulations, and field contacts experienced in planning, enforcement, response, and mitigation of hazardous materials incidents.

3495 (CONF-8906243–1) **Uncontrolled hazardous waste site cleanup programs in the US: An overview.** Chiu, Shen-yann; Tsai, S.Y. Argonne National Lab., IL (USA). [1989]. 15p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From Conference on industry and pollution prevention; Taipei (Taiwan); 15-16 Jun 1989. Order Number DE90002215. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Problems concerning environmental contamination resulting from releases of hazardous substances at uncontrolled hazardous waste sites have received widespread attention in the US since the early 1980s. Today, the Superfund program established under CERCLA and SARA is one of the most ambitious and expensive environmental efforts ever attempted in this nation. The US Environmental Protection Agency (US EPA) has already spent over $4 billion on the program, and is committed to spending an additional $6 billion over the next three years. It is estimated that the cost for cleaning up the contaminated sites in the US will be over $150 billion. The purpose of this paper is to present a general overview of the uncontrolled hazardous waste site remediation programs presently being conducted in the US. Remedial actions to be discussed involve assessment, characterization, and cleanup of contaminated sites. Remediation may involve efforts to clean up the soil, surface water,

groundwater, or some combination of those; techniques include stabilization, removal, treatment, and disposal of bulk wastes. Present regulatory frameworks, methods for prioritization of contaminated sites, procedures for remedial investigations, and decisions processes for selection of remedial technologies are outlined. Also presented are lessons learned and suggestions for applying US experience in Taiwan. 12 refs., 3 tabs.

3496 (CONF-8907103–12) **The Pacific Basin Consortium: A new device for problems without borders.** Drucker, H. Argonne National Lab., IL (USA). 1989. 3p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From Technology-based confidence building: energy and environment; Santa Fe, NM (USA); 9-14 Jul 1989. Order Number DE90002167. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Environmentally malignant chemicals have a way of crossing borders. Produced either as products (PCBs) or contaminants of industrially important chemicals (dioxin) or as the consequence of industrial activity (SO_x, NO_x), these agents travel as items of commerce, as hazardous wastes shipped from one nation to another, in the waters of international rivers, and in the atmosphere. The world invents some 1000 new chemicals every year, adding to the 60,000-70,000 agents currently in use, perhaps half of which either have not been examined relative to potential toxicity or are known to possess an environmental/health hazard. However, with these apparent risks come obvious benefits. Industrialization and the use of chemicals appear to be parallel functions. Agricultural efficiency seems to correlate with use of agricultural chemicals (fertilizers, herbicides, pesticides). The production, use, and transmission of cheap, efficient energy appears to depend upon the chemistries of combustible materials, insulators, conductors, light-weight plastics and alloys, all either producing or involving chemicals of environmental concern.

3497 (CONF-8911106–1) **The generation and control of hazardous waste in the Pacific Basin.** Cirillo, R.R. Argonne National Lab., IL (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 3. national conference on the management of hazardous wastes; Melborune (Australia); 19-21 Nov 1989. Order Number DE90002273. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Areas in the basin and on the rim of the Pacific Ocean are experiencing a growing concern with the management of chemical hazardous waste. About 41% of the world's population lives in the Pacific basin. By very rough estimates, almost 272 million metric tons of hazardous waste are being generated every year in this region. The problem is not confined to the large industrialized economies of the region. All areas of the Pacific Basin, from the large industrial giants to the small Pacific islands have already experienced the effects of improper treatment and disposal of hazardous wastes. This paper presents the results of a review of the scope of the hazardous waste problem in the Pacific Basin, identifies issues common to the region, and describes research needs. A survey of hazardous waste generation, treatment and disposal practices, and regulations controlling hazardous waste is presented. The paper also describes the Pacific Basin Consortium for Hazardous Waste Research, an organization of research institutes from around the region that have chosen to work together to address the technical questions involved in hazardous waste management. 2 refs., 3 figs., 1 tab.

3498 (LBL–27226) **Soil water and vegetation management for cleanup of selenium contaminated soils: Progress report.** Lawrence Berkeley Lab., CA (USA). May 1989. 74p. Sponsored by U.S. Department of the Interior. DOE Contract AC03-76SF00098. Order Number DE90002602. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Over the past year scientists have initiatived a new effort aimed at developing a soil water and vegetation management plan for Kesterson Reservoir. The plan is intended to result in a gradual depletion of the inventory of soluble selenium at the Reservoir through a combination agriculturally oriented practices that enhance dissipation of selenium from near surface soils. Agriculturally oriented processes that will contribute to depletion include microbial volatilization from the soils, direct volatilization by living plants, decomposition and volatilization of selenium-bearing vegetation, harvest and removal of seleniferous vegetation, and leaching. The benefits of using this integrated approach are that (1) no single mechanism needs to be relied upon to detoxify the soils, (2) a stable plant community can be established during this period so that impacts to wildlife can be more easily evaluated and controlled, (3) cleanup and management of the site can be carried out in a cost-effective manner. The management plan is also intended to facilitate control over wildlife exposure to selenium contaminated biota by creating a well managed environment. The majority of research associated with this new effort is being carried out at a 200 m by 50 m test plot in Pond 7. A two-line irrigation system , providing local groundwater as an irrigation supply, has been installed. Through an intensive program of soil water sampling, soil gas sampling, vegetation sampling, groundwater monitoring, and soil moisture monitoring, the mass balance for selenium under irrigated conditions is being evaluated. These studies, in conjunction with supplementary laboratory experiments will provide the information needed to develop an optimal management plan for the site. 23 refs., 38 figs., 10 tabs.

3499 (ORNL/FTR–3455) **[Ecosystem research on Walker Branch watershed]: Foreign trip report, October 22–28, 1989.** Elwood, J.W. Oak Ridge National Lab., TN (USA). 8 Nov 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002965. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The symposium and workshop on "Concepts in Ecosystem Research" was organized to bring together scientists and representatives from government ministries involved in funding environmental research in the FRG to discuss concepts in ecosystem research and to hear about a major ecosystem research project in the Bornhoved Lake District located near Kiel. The traveler presented a paper entitled "Ecosystem Research on Walker Branch Watershed," which is funded by the US Department of Energy's Office of Health and Environmental Research. The traveler also visited the Bornhoved Lake District, which is the site of a major new ecosystem research study involving forest, agricultural, and lake ecosystems. In addition, the traveler discussed approaches to organizing and managing a large interdisciplinary ecosystem research project with members of the steering committee for the Bornhoved Lake District project.

3500 (PB–89-229538/XAB) **Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 28 Dec 1988. 43p. (EPA/ROD/R–07-89/023). Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

The Findett/Hayford Bridge Road Ground Water site is located just north of the City of St. Charles, in St. Charles County, east-central Missouri. Land use in the site vicinity is primarily agricultural, but also includes a small industrial park containing Findett Corporation, Cadmus Corporation, and several other commercial and light industrial establishments. Until 1980, Findett Corporation reclaimed heat-transfer fluids or oils, some of which contained PCBs, and received waste solvents for reclamation or recycling. Subsequently, Findett has custom blended or manufactured organic chemicals for other companies. There is PCB-contaminated soil at the Findett facility as well as the adjacent Cadmus Corporation facility. The Elm Point Well Field is also at risk of contamination by releases from the site. The primary contaminants of concern affecting the soil and ground water are VOCs, and other organics including PCBs. The selected remedial action for the site includes onsite ground-water pumping and treatment using air stripping with discharge to the publicly owned treatment works; and excavation of contaminated soil with either offsite disposal or treatment.

3501 (PNL-SA–16809) **Regulatory requirements for groundwater monitoring networks at hazardous waste sites.** Keller, J.F. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891053–10: 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?, Richland, WA (USA), 16-19 Oct 1989). Order Number DE90002728. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In the absence of an explicit national mandate to protect groundwater quality, operators of active and inactive hazardous waste sites must use a number of statutes and regulations as guidance for

detecting, correcting, and preventing groundwater contamination. The objective of this paper is to provide a framework of the technical and regulatory considerations that are important to the development of groundwater monitoring programs at hazardous waste sites. The technical site-specific needs and regulatory considerations, including existing groundwater standards and classifications, will be presented. 14 refs., 2 tabs.

5103 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 2183, 2193, 2229, 2232, 2241, 2688, 3483, 3486, 3568, 3751

3502 (BMU–1988-196) **Ingestion of radiocesium and strontium-90 by self-suppliers and non-self-suppliers in the first year following the Chernobyl reactor accident. Data taken as a basis for derivation of secondary intervention reference levels.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene. 1988. 99p. (In German). Contract BMU St.Sch. 01038. Available from Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

In Southeast Bavaria, the region of Germany with the highest cesium (Cs) deposition, 20 self and non-self-suppliers were selected for observation of the ingestion and incorporation of radiocesium by means of check measurements of radioactivity in prepared diet duplicates and in the whole body. The results are comparatively analyzed. Surveys conducted in February/March 1987 show that both populations differ significantly in Cs incorporation. Children and adults among the self-suppliers revealed a Cs incorporation 3.5 times higher than that of the non-self-suppliers. An average Cs concentration of 8900 Bq was measured among the adult self-suppliers. By comparison, the average Cs concentration among the adult non-self-suppliers was only 2310 Bq. In the same period, a supply rate of 110 Bq/d (45-216 Bq/d) was measured among the adult self-suppliers, and a supply rate of 17 Bq/d (10-27 Bq/d) among the adult non-self-suppliers. The amount of activity incorporated per day was 77 Bq/d (64-96 Bq/d) among the younger children of the self-suppliers, and 32 Bq/d (24-40 Bq/d) among the older children of the non-self-suppliers. The specific activity of strontium 90 in dairy, meat and vegetable products mainly from the self-sufficiency areas was also analyzed. The average concentration of the activity of strontium 90 in raw milk was 0.4 Bq/l in February/March 1987, and the average specific activity for the other food products was 0.25-3 Bq/kg. The average values for the ingestion of strontium 90 over all the food products lie approximately between 0.3-0.5 Bq per person and day, and are comparable with the value of 0.3 Bq in the period before the reactor accident in Chernobyl. Starting from these values, the relative contamination of food as well as the effective dose equivalent of both groups of suppliers for the first year after the reactor accident in Chernobyl was measured. (orig./MG).

3503 (HW–33128) **Radiological Sciences Department annual report, research and development, fiscal year 1954.** Hanford Works, Richland, WA (USA). 15 Sep 1954. 29p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90002518. Available from NTIS, PC A03/MF A01 - OSTI.

The following material is a progress report of work performed in Radiological Sciences Research and Development during FY 1954. The report, primarily non-technical in nature, presents a summary of accomplishments achieved over the twelve-month period for each of the three programs: Biology, Biophysics and Radiological Engineering. A tabulation of manpower and costs associated with these activities is included.

3504 (HW–39558) **Radiological Sciences Department Annual report: Research and development, Fiscal year 1955.** Mickelson, M.L.; Kornberg, H.A.; Pearce, D.W.; Smith, J.M. General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation. 23 Sep 1955. 35p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90002521. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Declassified 15 May 1973.

The following material comprises a summary of work performed in Radiological Sciences Research and Development during FY 1955. The report, primarily non-technical in nature, presents accomplishments achieved over the twelve-month period in each of the three sections conducting research and development work: Biology, Biophysics, and Radiological Engineering. A tabulation of manpower and costs associated with these activities is included. 2 tabs.

3505 (INIS-mf–11557) **U, Th and K distributions inferred from regional geology and the terrestrial radiation profiles in India.** Sankaran, A.V.; Jayaswal, B.; Nambi, K.S.V.; Sunta, C.M. Bhabha Atomic Research Centre, Bombay (India). 1986. 104p. Order Number DE90608113. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The natural background radiation or natural radioactivity in environment in any region is mainly due to gamma radiation emanating from uranium, thorium and potassium contents of the ground matter of that region. Instead of carrying out accurate but tedious radiometric surveys at site, a fair estimate of the radiation value of any place can be calculated by knowing different types of rocks exposed at that place and the geochemical distribution of radioelements in those exposed rocks. The geochemical distribution in the exposed rocks can be computed by using worldwide average values of U, Th and K for various kinds of crystal rocks. These average values are obtained from the published geochemical data for different rock types from all over the world. Using this method, the geochemical distributions of U, Th and K are inferred for different states of India and the terrestrial radiation profiles in India are prepared. For this work, the geologic information data contained in the maps and publications of the Geological Survey of India were used. Annual radiation levels are expressed in microgray per year (μGy/y) using conversion factors recommended by UNSCEAR (1982). These represent the absorbed dose levels in air at 1 meter above the earth's surface and take into account the skyshine effect from the earth as an infinite radioactive source. Contributions from cosmic rays are not included in these estimates. Multicolour and monotone (black) maps depicting the fluctuating profile of radiation across the individual States of India and the country as a whole are given. Also the details of the radiation contribution of different stratigraphic horizon of each State in the country have been tabulated. It is observed that 1 per cent of the sub-continent shows radiation levels greater than 2000 μGy/y. (M.G.B.). 91 refs., 25 tabs., 35 fi gs.

3506 (Juel–2250) **Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report.** Steffens, W.; Fuehr, F.; Mittelstaedt, W.; Klaes, J.; Foerstel, H. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie; Bundesministerium des Innern, Bonn (Germany, F.R.). Dec 1988. 123p. (In German). Contract BMI St.Sch. 702a. Order Number DE90721871. Available from NTIS (US Sales Only), PC A06/MF A01.

In lysimetric field experiments with 2 soil types most common in the Federal Republic of Germany the effects of a continuous contamination as well as of a temporary contamination of the soil caused by a possible accident were simulated to allow forecastings on the resorption of radionuclides by farm plants. Parallel pot experiments (8 kg of soil) in greenhouses and in the field and small pot experiments under reproducible climatic chamber conditions were to examine wether or not transfer data from laboratory and pot experiments can be applied to field conditions. In addition to this, soil types representative according to soil mapping were taken from the locations of the nuclear power plants Biblis and Stade, and their properties were determined. In large-scale comparative pot experiments the relative transfer factors were determined. (orig./DG).

3507 (NIR–1/88) **HTO deposition through gas exchange between soil and atmosphere.** Feinhals, J. Niedersaechsisches Inst. fuer Radiooekologie (Germany, F.R.); Hannover Univ. (Germany, F.R.). Fachbereich Physik. Jun 1988. 137p. (In German). Order Number DE90721890. Available from NTIS (US Sales Only), PC A07/MF A01.

Theoretical considerations show that the ratio of HTO/H_2O molecules, i.e. the specific activity, is not the same in atmospheric humidity and moisture absorption but differs by the so-called specific activity coefficient k. On this basis a computer model (ATHOS) was developed which allowed the calculation of both the surface contamination of the soil due to the gas exchange with a contaminated atmosphere and the depth-specific distribution of the soil acitvity. On the one hand the equations base on a modified Philip-de Vries theory, and on the other hand on a large number of soil column experiments which served the examination of the influence of parameters of microclimate and soil physics on the absorption and diffusion of tritiated water vapour under simulated conditions Above all the individual capability of each soil type to absorb moisture must be taken into consideration in connection with the HTO transfer. In this context theoretical and experimental examinations were carried out indicating a practice-related possibility to determine the soil-specific absorption capability. (orig./DG).

3508 (ORNL/RASA–87/36) **Results of the radiological survey at 9 Hancock Street, Lodi, New Jersey (LJ028).** Cottrell, W.D.; Floyd, L.M.; Francis, M.W.; Mynatt, J.O. Oak Ridge National Lab., TN (USA). Sep 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90002919. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 9 Hancock Street, Lodi, New Jersey (LJ028), was conducted during 1985 and 1986. Some radionuclide measurements were greater than typical background levels in the northern New Jersey area. However, results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action Program criteria. 5 refs., 6 figs., 3 tabs.

3509 (ORNL/RASA–88/18) **Results of the radiological survey at 72 Sidney Stret, Lodi, New Jersey (LJ067).** Foley, R.D.; Carrier, R.F.; Floyd, L.M.; Crutcher, J.W. Oak Ridge National Lab., TN (USA). Sep 1989. 24p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001279. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residues used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 72 Sidney Street, Lodi, New Jersey (LJ067), was conducted during 1987. Results indicated concentrations of ^{232}Th slightly in excess of the DOE remedial action criterion for subsurface soil. This finding, coupled with the fact that adjacent properties have been designated by DOE for remedial action, and that the old Lodi Brook streambed is apparently beneath the property, suggests that it be considered for inclusion in the DOE remedial action program. 4 refs., 5 figs., 3 tabs.

3510 (ORNL/RASA–88/30) **Results of the radiological survey at 133 Maywood Avenue, Maywood, New Jersey (MJ025).** Foley, R.D.; Carrier, R.F.; Floyd, L.M.; Crutcher, J.W. Oak Ridge National Lab., TN (USA). Oct 1989. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90001278. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 133 Maywood Avenue, Maywood, New Jersey (MJ025), was conducted during 1987. The survey results demonstrate that all radionuclide concentrations and measurements conform to DOE remedial action criteria. All values are at or below typical background values found in northern New Jersey. 5 refs., 2 figs., 3 tabs.

3511 (ORNL/RASA–89/5) **Results of the independent verification of radiological remedial action at 381 East 3rd South Street, Monticello, Utah (MS00140).** Crutcher, J.W.; Smuin, M.W. Oak Ridge National Lab., TN (USA). Oct 1989. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003279. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In 1980 the site of a vanadium and uranium mill at Monticello, Utah, was accepted into the US Department of Energy (DOE's) Surplus Facilities Management Program, with the objectives of restoring the government-owned mill site to safe levels of radioactivity, disposing of or containing the tailings in an environmentally safe manner, and performing remedial actions on off-site (vicinity) properties that had been contaminated by radioactive material resulting from mill operations. During 1986, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity at 381 East 3rd South Street, Monticello, Utah. The Pollutant Assessments group (PAG) of Oak Ridge National Laboratory was assigned the responsibility of verifying the data supporting the adequacy of remedial action and confirming the site's compliance with DOE guidelines. The PAG found that the site successfully meets the DOE remedial action objectives. Procedures used by PAG are described. 3 refs., 2 tabs.

3512 (ORNL/RASA–89/7) **Results of the independent verification of radiological remedial action at 98 East 5th South Street, Monticello, Utah (MS00076).** Crutcher, J.W.; Smuin, M.W. Oak Ridge National Lab., TN (USA). Oct 1989. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003278. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In 1980 the site of a vanadium and uranium mill at Monticello, Utah, was accepted into the US Department of Energy's (DOE's) Surplus Facilities Management program with the objectives of restoring the government-owned mill site to safe levels of radioactivity, disposing of or containing the tailings in an environmentally safe manner, and performing remedial actions on off-site (vicinity) properties that had been contaminated by radioactive material resulting from mill operations. During 1984, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity property at 98 East 5th South Street, Monticello, Utah. The Pollutant Assessments Group (PAG) of Oak Ridge National

Laboratory was assigned the responsibility of verifying the data supporting the adequacy of remedial action and confirming the site's compliance with DOE guidelines. The PAG found that the site successfully meets the DOE remedial action objectives. Procedures used by PAG are described. 3 refs., 2 tabs.

3513 (ORNL/RASA–89/8) **Results of the independent verification of radiological remedial action at 196 East 3rd South Street, Monticello, Utah (MS00083).** Crutcher, J.W.; Smuin, M.W. Oak Ridge National Lab., TN (USA). Oct 1989. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003281. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In 1980 the site of a vanadium and uranium mill at Monticello, Utah, was accepted into the US Department of Energy's (DOE) Surplus Facilities Management program with the objectives of restoring the government-owned mill site to safe levels of radioactivity, disposing of or containing the tailings in an environmentally safe manner, and performing remedial actions on off-site (vicinity) properties that had been contaminated by radioactive material resulting from mill operations. During 1984 and 1985, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity property at 196 East 3rd South Street, Monticello, Utah. The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory was assigned the responsibility of verifying the data supporting the adequacy of remedial action and confirming the site's compliance with DOE guidelines. The PAG found that the site successfully meets the DOE remedial action objectives. Procedures used by PAG are described. 3 refs., 2 tabs.

3514 (ORNL/RASA–89/9) **Results of the independent verification of radiological remedial action at 384 South 2nd East Street, Monticello, Utah (MS00084).** Crutcher, J.W.; Smuin, M.W. Oak Ridge National Lab., TN (USA). Oct 1989. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003282. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In 1980 the site of a vanadium and uranium mill at Monticello, Utah, was accepted into the US Department of Energy's (DOE's) Surplus Facilities Management Program, with the objectives of restoring the government-owned mill site to safe levels of radioactivity, disposing of or containing the tailings in an environmentally safe manner, and performing remedial actions on off-site (vicinity) properties that had been contaminated by radioactive material resulting from mill operations. During 1984, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity property at 384 South 2nd East Street, Monticello, Utah. The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory was assigned the responsibility of verifying the data supporting the adequacy of remedial action and confirming the site's compliance with DOE guidelines. The PAG found that the site successfully meets the DOE remedial action objectives. Procedures used by PAG are described. 3 refs., 2 tabs.

3515 (PNL-SA–16766) **Strontium-90 in Canada goose eggshells: Non-fatal monitoring for contamination in wildlife.** Rickard, W.H.; Eberhardt, L.E. Pacific Northwest Lab., Richland, WA (USA). Aug 1989. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891053–3: 28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?, Richland, WA (USA), 16-19 Oct 1989). Order Number DE90001893. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Strontium-90 as measured in eggshells taken form newly hatched eggs in 42 Canada goose nests. Higher-than-background levels were present in eggshells from only a few nests. The origin of the enhanced strontium-90 levels appears to be Hanford Site facilities. However, the amounts measured are too low to expect to see any deleterious health or reproductive effects on the goose population. Eggshells provide an efficient way to obtain biological samples for environmental monitoring without inducing goose mortality. 10 refs., 2 figs.

3516 (UCRL–100936) **More about breathing on the Mesa.** Woodward, E.C. Lawrence Livermore National Lab., CA (USA). Sep 1989. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8909163–6: 5. symposium on containment of underground nuclear detonations, Santa Barbara, CA (USA), 19-21 Sep 1989). Order Number DE90002973. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Atmospheric pressure cycling ("breathing") has assisted diffusion in enabling gaseous radioactive fission debris to reach the surface, as detected by noble gas samplers, after a number of Pahute Mesa events. More and updated information on the geology and location of the "breathing" phenomenon may better define its likelihood of occurrence. 1 fig., 1 tab.

5105 Site Resource and Use Studies

Refer also to citation(s) 2079, 3492, 3576, 3807, 3808, 3813

3517 (PNL–6982) **Summary of commercial conservation programs environmental issues and program consistency.** Beachler, M.C. Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 93p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC06-76RL01830. Order Number DE90002737. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Pacific Northwest Laboratory (PNL) conducted this study for the Office of Energy Resources of the Bonneville Power Administration. The purpose of the report is to compare and contrast the environmental requirements and issues involving Bonneville's residential conservation programs. In addition to environmental issues that Bonneville has addressed in environmental documents, this report also briefly examines new issues that may affect residential conservation programs. The key environmental concern confronting each of the programs with measures aimed at reducing air leakage in houses (both new and existing) is indoor air quality. There are inconsistencies in how the Weatherization Program and the New Homes programs approach indoor air quality. However, these differences make sense, given the character and constraints affecting how each program operates. Newer issues that have arisen include global warming, potential health effects of mineral and glass fibers, and possible fire hazards associated with plastic foam and cellulose insulation. Bonneville staff are aware of these issues as they relate to conservation programs. No action appears necessary at this time.

5106 Regulations

Refer also to citation(s) 2127, 2764, 2765, 2766, 2767, 2768, 2769, 2771, 2772, 2773, 2774, 3579, 3582, 3583, 3584, 3585, 3589, 3591, 3592

3518 (PB–89-221436/XAB) **Response to comments: Background document for the second third-land disposal restrictions proposed rule: Policy-related comments.** ICF Technology, Inc., Fairfax, VA (USA). 8 Jun 1989. 193p. (EPA–530/SW-89/048C). Available from NTIS, PC A09/MF A01.

See also PB–89-221535.

The Agency requested public comments on the proposed rule to prohibit land disposal of the second one-third of the schedule of restricted hazardous wastes, known as the Second Third. The regulated community, environmental organizations, trade associates, State and Federal agencies, and concerned citizens submitted over 90 written comments on the proposed rule. EPA compiled three volumes of the comments. Document 048C addresses comments on broad policy issues.

3519 (PB–89-221535/XAB) **Response to the Second Third wastes treatment standards: Related comments for the Second Third land-disposal restrictions proposed rule (Issue Numbers 1 through 12).** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. 8 Jun 1989. 1460p. (EPA–530/SW-89/048D). Available from NTIS, PC A99/MF E10.

See also PB–89-221543. Portions of this document are not fully legible.

The Agency requested public comments on the proposed rule to prohibit the land disposal of the second one-third of the schedule of restricted hazardous wastes, known as the Second Third. The regulated community, environmental organizations, trade associates, State and Federal agencies, and concerned citizens submitted over

90 written comments on the proposed rule. EPA compiled three volumes of the comments. The document addresses comments on waste-specific treatment standards.

3520 (PB–89-221543/XAB) **Response to capacity-related comments submitted on the Second Third proposed land disposal restrictions rule.** Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste. 8 Jun 1989. 162p. (EPA–530/SW-89/048E). Available from NTIS, PC A08/MF A01.

See also PB–89-221436. Portions of this document are not fully legible.

The Agency requested public comments on the rule to prohibit the land disposal of the second one-third of the schedule of restricted hazardous wastes, known as the Second Third. The regulated community, environmental organizations, trade associations, State and Federal agencies, and concerned citizens submitted over 90 written comments on the proposed rule. EPA compiled three volumes of the comments. The volume addresses comments on waste-specific capacity concerns.

3521 (PB–89-224950/XAB) **Bench-scale fixation of soils from the Tacoma Tar Pits Superfund Site. Final report.** Rupp, G. Nevada Univ., Las Vegas, NV (USA). Environmental Research Center. Jul 1989. 106p. Available from NTIS, PC A06/MF A01.

This report documents the result of a bench-scale soil-fixation study conducted with materials from the Tacoma Tar Pits Superfund Site. Chemical fixation (also called stabilization/solidification) is a relatively new technique for remediating contaminated soils. It entails both immobilization of contaminants via sorption or chemical reaction and physical transformation of the soil into a firm, impervious 'monolith.' Fixation has been used for years to immobilize metals in low-level radioactive wastes and specialized industrial wastes, such as baghouse dusts. It has not been commonly used at sites with organic contamination, however. The study utilized materials contaminated with metals and several types of organic contaminants including benzene, toluene, xylene, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls. Samples of heavily contaminated soils and wastes from the site were chemically fixed using a proprietary product, and the resulting monoliths were subjected to various physical, chemical, and leaching tests. The purpose was to assess the efficacy of fixation for a complicated matrix, i.e., one that was physically heterogeneous and contained several classes of contaminants.

3522 (PB–89-225494/XAB) **Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 29 Jun 1988. 70p. (EPA/ROD/R–05-88/069). Available from NTIS, PC A04/MF A01.

The Belvidere Landfill, is located just outside the City of Belvidere, County of Boone, Illinois. The City of Belvidere owned the landfill from 1939 to 1973, operating first as a municipal landfill until 1965 and then as an industrial landfill until 1973. The primary contaminants of concern affecting the soil and ground water include: organics, PCBs, PAHs, metals, and lead. The selected remedial action for the site includes: RCRA Subtitle C capping over the 19.3-acre landfill; treatment or containment of soil from the drum-disposal area following resampling to determine the magnitude of PCB contamination; ground water pump and treatment possibly using air stripping with discharge to either the Kishwaukee River or the city treatment plant; ground-water monitoring; pond- and river-fish monitoring; installation of an upgraded fence; deed restrictions to control unacceptable onsite activities and construction; and flood control measures to prevent erosion of the cap and landfill contents.

3523 (PB–89-225510/XAB) **Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 29 Sep 1988. 29p. (EPA/ROD/R–05-88/079). Available from NTIS, PC A03/MF A01.

The 4.5-acre Poer Farm site is located about 4 miles north of Charlottesville, in Hancock County, Indiana. The site is an abandoned tract of land with a collapsed house and barn and an old, inactive well that lies southeast of the house. The surrounding area is open farmland. The nearest house is about 0.25 mile from the site and the nearby residents rely on private wells for their water supply. There are about 270 homes with a population of about 2,400 within 3 miles of the site. In 1973, approximately 260 drums of offgrade solvents and paint resins were stockpiled on the Poer property. In 1981 and 1983, the drums and an onsite well were tested and found to contain elevated levels of arsenic, cadmium, lead, and mercury. Emergency cleanup activities were conducted in the summer of 1983. All wastes were removed from the site and six to eight inches of soil were removed from the drum storage areas. Subsequent sampling showed significantly decreased levels of the heavy metals. The site was fenced and warning signs were posted. An investigation in 1988 indicated that contaminant levels were below Federal and State Health Standards and that there was no threat to human health or the environment.

3524 (PB–89-225528/XAB) **Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 28 Jun 1988. 47p. (EPA/ROD/R–06-88/037). Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

The South Valley/Edmunds Street site is a large area in Albuquerque, New Mexico, surrounding the municipal water well known as San Jose 6. Within this large area are a number of industrial properties owned and operated by different groups and individuals. Analyses of the area have shown significant levels of industrial solvents in the soil, and a plume of contaminated ground water starting at the drainage pit area and extending to the east. The contaminated ground water currently poses a direct threat to Albuqerque's water supply by moving toward the city's well fields. The primary contaminants of concern affecting the ground water include VOCs such as PCE and TCE. The selected remedial action for the site includes: ground water pump and treatment using air stripping (packed-tower aeration) with reinjection of the treated water into the aquifer through infiltration galleries; and ground water and air monitoring.

3525 (PB–89-225536/XAB) **Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 30 Sep 1988. 81p. (EPA/ROD/R–03-88/068). Available from NTIS, PC A05/MF A01.

See also PB–85-213858. Portions of this document are not fully legible.

The Tyson's Dump site is an abandoned septic and chemical waste-disposal facility on a four-acre plot bordered on the east and west by unnamed tributaries of the Schuylkill River. During its period of operation from 1962 to 1970, several formerly unlined lagoons were used to dispose of various industrial, municipal and chemical wastes. Spills and overflows reportedly occurred, dispensing contaminants throughout the site. Surface-water runoff and seeps contributed to offsite migration of wastes toward the Schuylkill River. In 1973 the State ordered the original onsite disposal facility closed. The primary contaminants of concern affecting the ground water are VOCs including 1,2,3-trichloropropane, total xylenes, toluene, and other organics. The selected remedial action for the site includes pumping and treatment of contaminated ground water with discharge of treated water to the river; offsite incineration of organic-phase condensate produced from steam regeneration of vapor-phase carbon beds; and ground-water monitoring.

3526 (PB–89-225544/XAB) **Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 30 Dec 1987. 107p. (EPA/ROD/R–10-88/011). Available from NTIS, PC A06/MF A01.

Portions on this report are not fully legible. See also PB–85-214179.

The Tacoma Tar Pits site covers approximately 30 acres within the Commencement Bay-Nearshore/Tideflats site in Tacoma, Pierce County, Washington. Currently, there is concern for the site's impact on surface-water quality; many local industries use ground water from onsite wells. The primary contaminants of concern affecting

surface water and soil include: benzene, PAHs, PCBs, and lead. The selected remedial action for the site includes: excavation of all contaminated soils exceeding 1% total PAHs and all surface soils exceeding a 10^{-6} lifetime cancer risk level with stabilization of all excavated soils in a polymer/cement mixture; capping of the stabilized matrix with asphalt; channeling and managing of surface waters; ground-water monitoring; and removal and treatment of ponded water.

3527 (PB–89-225577/XAB) **Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 31 Mar 1988. 228p. (EPA/ROD/R–01-88/031). Available from NTIS, PC A11/MF A01.

Portions of this document are not fully legible.

The Cannon Engineering Corporation (CEC) facility is located in a small industrial park in the western part of the Town of Bridgewater, Plymouth County, Massachusetts. CEC, which has owned the property since 1974, handled, stored, and incinerated chemical waste onsite from 1974 to 1980. EPA conducted site investigations between 1980 and 1982, and in October 1982, Massachusetts contracted for the removal of sludge and liquid waste from onsite tanks and drums. In January 1988, EPA provided for the removal and disposal of numerous hazardous materials abandoned at the site. This remedial action addresses three discrete areas of soil and sediment contamination. The primary contaminants of concern affecting the ground water, soil, and debris are VOCs including benzene, TCE, and vinyl chloride, and other organics including PCBs and PAHs. The selected remedial action includes: excavation and onsite treatment of VOC-contaminated soil by thermal aeration, and excavation and offsite treatment of PCB-contaminated soil by incineration; decontamination, removal, and disposal of contaminated buildings, tanks, and structures; additional soil sampling; ground water monitoring.

3528 (PB–89-225908/XAB) **Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. Jun 1988. 157p. (EPA/ROD/R–05-88/068). Available from NTIS, PC A08/MF A01.

Portions of this document are not fully legible.

The 11.5-acre Summit National site is a former coal strip mine approximately 45 miles southeast of Cleveland. Summit National Liquid Services operated a solvent-recycling and waste-disposal facility on the site from 1973 to 1978. Solvents, paint sludges, phenols, cyanide, arsenic, and other liquid wastes were stored, incinerated, and buried or dumped during site operations. All onsite media are contaminated with a variety of organic and inorganic compounds, and investigations indicate that offsite areas also are affected. The primary contaminants of concern affecting soil, sediments, ground water, and surface water are VOCs including benzene, toluene, TCE and xylenes, other organics including phenols, PAHs and PCBs, and metals including arsenic and chromium. The selected remedial action for the site includes: excavation and onsite incineration of contaminated soil and sediments and the contents of approximately 1,600 buried drums and 4 tanks, with disposal of incinerator residuals in an onsite RCRA landfill; groundwater pump and treatment and onsite surface-water treatment and discharge of treated water to downgradient surface water; dismantling and onsite disposal of all onsite structures; ground-water and surface water monitoring; and residence relocation.

3529 (PB–89-229504/XAB) **Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 30 Dec 1988. 132p. (EPA/ROD/R–08-89/022). Available from NTIS, PC A07/MF A01.

See also PB–87-189874. Portions of this document are not fully legible.

The Libby Ground Water Contamination site (also known as the Champion Mill site or the Libby Pesticide site) is located on the Champion International Corporation lumber and plywood mill in the City of Libby, Lincoln County, Montana. The contaminated soil/source area is within the confines of the facility; however, groundwater contamination extends well into the City of Libby. Wood-treating fluids and their constituents, including creosote and PCP, are the contaminants of concern at the site. They are found in soil and sediments at several different locations, including former waste pits, tank storage areas, and butt dip and treatment sites. The contamination is the result of spent fluids, overflow of treatment tanks, and spills. In addition to creosote and PCP, certain carrier fuels or oils were used at the site and contributed VOC contaminants. The site has been divided into three operable units; however, they require concurrent remediation. The primary contaminants of concern affecting the soil, sediments, and ground water at the site are VOCs including benzene; other organics including dioxin, PAHs (creosote constituents), and PCP; metals including arsenic; and oil.

3530 (PB–89-229546/XAB) **Superfund Record of Decision (EPA Region 2): Ciba-Geigy, NJ. (First Remedial Action), April 1989.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 24 Apr 1989. 123p. (EPA/ROD/R–02-89/076). Available from NTIS, PC A06/MF A01.

Portions of this document are not fully legible.

The Ciba-Geigy Chemical Corporation site is located in Dover Township, Ocean County, New Jersey. From 1952 to 1988, a variety of synthetic organic pigments, organic dyestuffs and intermediates, and epoxy resins were manufactured at the site. The company disposed of chemical wastes onsite in several locations. The drum-disposal area and lime-sludge-disposal area were closed and capped in 1978. About this time, the filtercake disposal area was also closed and covered with soil. Ground-water contamination is migrating from these inactive disposal sites easterly towards the Toms River. Contaminants are present in leaking drums, waste sludges, soils, and ground water. The primary contaminants of concern affecting the ground water are VOCs including benzene, PCE, TCE, and toluene; and metals including arsenic and chromium. The selected remedial action for the site includes sealing contaminated residential irrigation wells; on- and off-site ground-water pumping with onsite treatment followed by temporarily retaining the ground water in basins for monitoring and subsequent discharge to the Toms River; and implementation of a river- and ground-water monitoring program.

3531 (PB–89-229553/XAB) **Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 4 Nov 1988. 59p. (EPA/ROD/R–07-89/022). Available from NTIS, PC A04/MF A01.

Portions of this document are not fully legible.

The 2.7-acre Dupont Impoundment of the Todtz Farm site is located on a 120-acre farm 1.25 miles west of Camanche, Iowa. Originally a sand and gravel mine, the landfill received municipal waste from 1969 to 1975. Dupont disposed of an estimated 4,300 tons of wet end cellophane process wastes from 1971 until its closure in 1975. Impoundment wastes are periodically in direct contact with the ground water beneath the site, which flows southeasterly toward the Mississippi River. Domestic wells and the municipal water-supply wells for Camanche located downgradient of the site may be affected by contamination from the site. In addition, several ponds and lakes in the vicinity are potential receptors for contaminated runoff and recharge. The primary contaminants of concern affecting the ground water are VOCs including toluene and benzene, and metals including arsenic, lead, and chromium. The selected remedial action for the site includes installation of a soil cover over the Dupont Impoundment; implementation of institutional controls including deed and land-use restrictions; provision of an alternate water supply for an affected residence by relocating an existing well; and ground-water monitoring.

3532 (PB–89-229561/XAB) **Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 22 Dec 1988. 47p. (EPA/ROD/R–06-89/047). Available from NTIS, PC A03/MF A01.

The 4.2-acre Pesses Chemical Company site is located in Tarrant County, Ft. Worth, Texas. The site is in a light industrial and commercial area with an estimated 19,500 people residing or working within a one-mile radius. In June 1979, the Pesses Company began operations to reclaim cadmium and nickel from dry-cell batteries and metal sludges. In January 1981, site operations were discontinued. Heavy metals contamination from airborne dust and surface-water runoff are the main potential threats at the site. The primary contaminants of concern affecting the soil, buildings and equipment, and debris are metals including cadmium, lead, and nickel. The selected remedial action for the site includes excavation of contaminated offsite soil and wastes, and consolidation with onsite contaminated soil, followed by in-situ stablization; decontamination of the metal warehouse and equipment with resultant solid wastes combined with the soil remediation, and waters treated and discharged into the sewer system; offsite disposal of drums and debris, as well as equipment that cannot be adequately cleaned, and offsite deep-well injection of waste water above POTW discharge requirements; and cleaning and sealing the sumps.

3533 (PB–89-229579/XAB) **Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 5 Jan 1989. 38p. (EPA/ROD/R–04-89/043). Available from NTIS, PC A03/MF A01.

Portions of this document are not fully legible.

The American Creosote Works (ACW) site is located immediately southwest of Jackson, in central Madison County, Tennessee. ACW conducted wood-preserving operations using both creosote and PCP from the early 1930s until December 1981. Untreated process waste water and potential contaminated storm water runoff were discharged directly into Central Creek until 1973, at which time a levee was constructed to retain surface water runoff. The soil borrow pits used for the levee construction became sludge storage lagoons. A waste water treatment system was installed onsite during 1974 and 1975 and operated until 1981. The selected remedial action for the site includes consolidation and incineration of sludges in the vicinity of the buildings and tanks; on- or offsite incineration of the oils and sludges from the tanks; treatment of tanked process liquids onsite using a sand filter, filter press, and carbon adsorption unit, followed by discharge to a surface stream; decontamination and offsite disposal of site structures; construction of a flood-protection dike; deed restrictions and site fencing; and site stabilization including monitoring onsite water levels behind the dikes and pumping, treating (as needed), and discharging impounded water pending a final remedy.

3534 (PB–89-229587/XAB) **Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 31 Mar 1989. 51p. (EPA/ROD/R–03-89/067). Available from NTIS, PC A04/MF A01.

Portions of this document are not fully legible.

The M.W. Manufacturing site is a former copper recovery facility located in Montour County, Pennsylvania, two miles north of Danville. M.W. Manufacturing was engaged in secondary copper recovery from scrap wire, using both mechanical and chemical processes. Granular carbon wastes generated by the chemical process was dumped onsite, and spent solvents and acids were allegedly disposed of onsite. The initial remedial investigation revealed several areas posing potential threats to public health: the carbon waste pile, four wire-fluff waste piles, a surface impoundment, buried lagoon and contaminated soils, drums and storage tanks. The remedial action addresses the concerns for direct contact with and migration to ground water of contaminants from the carbon waste pile. The primary contaminants of concern affecting the soil are VOCs including PCE and TCE; organics including PCBs; and metals including lead. The selected remedial action for the site includes excavating the carbon waste pile and transporting the waste offsite to an incinerator facility and disposing of the ash in an offsite RCRA hazardous-waste landfill.

3535 (PB–89-229595/XAB) **Superfund Record of Decision (EPA Region 3): Wildcat Landfill, DE. (Second Remedial Action), November 1988. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 28 Nov 1988. 30p. (EPA/ROD/R–03-89/065). Available from NTIS, PC A03/MF A01.

See also PB–89-196752.

The Wildcat Landfill is located 2.5 miles southeast of Dover in Kent County, Delaware. A 2.7-acre pond, formed by the landfill blocking natural drainage from upland areas, is located along the northwestern border of the site. The landfill was operated as a State-permitted sanitary landfill between 1962 and 1973, accepting both municipal and industrial wastes. During its 11 years of operation, the facility routinely violated operating and other permits issued by the regulatory agencies. In August 1973 the facility was ordered closed by the state and the site owners were required to cover the site with soil and vegetation. EPA began investigating the site in 1982. Industrial wastes suspected to have been disposed of onsite include latex waste and paint sludges. The primary contaminants of concern affecting the sediments and surface water in the pond are metals including arsenic, chromium and lead. The selected remedial action for the site includes: draining, filling, and revegetating the pond area consistent with the landfill cover; constructing a new pond elsewhere on the site; implementing institutional controls for land use restrictions; and ground water-monitoring upgradient of the new pond.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

Refer also to citation(s) 2128, 2280

3536 (BR–82(11.111)) **Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Alewife and blueback herring.** Bozeman, E.L. Jr.; Van Den Avyle, M.J. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Coastal Ecology Group; Fish and Wildlife Service, Washington, DC (USA); Georgia Univ., Athens, GA (USA). Georgia Cooperative Fishery Research Unit. Aug 1989. 18p. Sponsored by U.S. Department of the Interior. (TR-EL–82-4/82(11.111)). Available from OSTI - US Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458.

Species profiles are summaries of the literature on taxonomy, life history, and environmental requirements of coastal fishes and aquatic invertebrates. They are prepared to assist with impact assessment. The alewife (*Alosa pseudoharengus*) and blueback herring (*A. aestivalis*) are morphologically and ecologically similar anadromous species of clupeids. The blueback herring is common throughout the South Atlantic Region, but the alewife occurs primarily in North Carolina and northern parts of South Carolina. These species spawn in spring in freshwater or brackish, tidally influenced portions of coastal rivers. Blueback herring initially use freshwater habitats for nursery areas, and then migrate downriver to brackish estuaries, where they overwinter prior to migrating to sea the following spring. Alewives use brackish water or tidal freshwater as nursery areas until they migrate to coastal waters in winter or the following spring. Landlocked populations of blueback herring occur in several southeastern reservoirs. Both species are ecologically important by serving as prey for many other fishes; they are economically important because they support commercial inshore and offshore fisheries. Little information is available on environmental factors that limit these species in the South Atlantic Region. Adults of both species have broad salinity tolerances, but blueback herring appear to require access to freshwater for successful reproduction. 76 refs., 2 figs., 2 tabs.

3537 (BR–82(11.113)) **Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Brown rockfish, copper rockfish, and black rockfish.** Stein, D.; Hassler, T.J. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Coastal Ecology Group; Fish and Wildlife Service, Washington, DC (USA); Oregon State Univ., Corvallis, OR (USA). Coll. of Oceanography; Humboldt State Univ., Arcata, CA (USA). California Cooperative Fishery Research Unit. Sep 1989. 15p. Sponsored by U.S. Department of Defense; U.S. Department of the Interior. (TR-EL–82-3/82(11.113)). Available

from OSTI; US Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Boulevard, Slidell, LA 70458.

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. They are designed to assist in environmental impact assessment. Rockfishes are the basis of very important sport and commercial fisheries in the northeastern Pacific. Exploitation is increasing. Brown rockfish (Sebastes auriculatus), copper rockfish (S. caurinus), and black rockfish (S. melanops) are three important members of this family. Two of the species occur throughout the Pacific Southwest region; the black rockfish occurs only from about Santa Barbara northward. The habitats and foods differ significantly among species, although at certain time and places they may overlap. Black rockfish tend to be pelagic; the other two species are benthic. Their foods generally reflect these differences in habitats. These species may compete with one another and with other rockfish and benthic species for habitat. The environmental factors determining distribution, growth, and survival are generally unknown. All rockfish have internal fertilization and bear live young. The reproductive behavior, spawning times, and spawning areas of these species are poorly known, although larvae of all have been described. Growth patterns are not well understood. All three species are apparently rather long-lived.

3538 (BR–85(7.27)) **The ecology of riparian habitats of the southern California coastal region: A community profile.** Faber, P.M.; Keller, E.; Sands, A.; Massey, B.M. National Wetlands Research Center, Slidell, LA (USA); Faber (Phyllis M.), Mill Valley, CA (USA); Keller (Ed), Santa Barbara, CA (USA); Sands (Anne), Mill Valley, CA (USA); Massey (Barbara M.), Long Beach, CA (USA). Sep 1989. 152p. Sponsored by U.S. Department of the Interior. Available from NTIS, PC A08/MF A01 - OSTI.

In the 200 years since California's settlement by Europeans, almost every river in southern California has been channelized or dammed to allow development on the floodplains, causing the loss of a highly productive ecosystem. The riparian zone occurs along streambanks where soils are fertile and water is abundant; amphibians, reptiles, birds, and mammals all move back and forth across the riparian zone from streams into adjacent wetland and upland areas. Irreversible alterations of the riparian ecosystem result from the diversion or loss of transported water to the system through diking, damming, channelization, levee building, or road construction. Clearing for crops, grazing, or golf courses is potentially reversible as long as the water supply remains unaltered. Successful restoration work requires early agreement on project goals, site-specific restoration design, correct project implementation, enforcement of permit conditions, a maintenance and management program, and long-range monitoring. 288 refs., 54 figs., 13 tabs.

3539 (DOE/ER/60301–10) **Pathogenic regulation of running water macroinvertebrates: Progress report, January 1, 1989–October 15, 1989.** Cummins, K.W.; Wilzbach, M.A. Pittsburgh Univ., PA (USA). Pymatuning Lab. of Ecology. 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-85ER60301. Order Number DE90002704. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The research during the second year focused on a large scale laboratory and field experiment on factors regulating growth and mortality of populations of the stream shredder caddisfly *Pycnopsyche guttifer*. This species, which is an obligate shredder feeding on leaf litter in woodland streams during its autumn-winter growth period, was selected because of the extensive pool of background data that are available, the ease with which its terrestrial eggs can be collected, and its suitability for laboratory culture and field observations. The species is univoltine and it is widely distributed in the eastern US, but did not occur naturally in the specific stream, Piney Run, MD, into which a population was introduced. 13 figs., 1 tab.

3540 (GSF–26/88) **Distribution of heavy metals and anions in the groundwater of quaternary gravel deposits in the Munich area (Dornach). Laboratory and field test results.** Zahn, M.T. Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie; Muenchen Univ. (Germany, F.R.). Fakultaet fuer Geowissenschaften. Dec 1988. 147p. (In German). Order Number DE90717914. Available from NTIS (US Sales Only), PC A07/MF A01.

The following 10 substances were selected, the occurence of which in groundwater is of particular interest either because of their toxicity or in connection with the fertilization of agricultural areas or in connection with the erosion of primary or secondary deposits: As, Pb, Cd, Hg, K, Na, nitrate, sulphate, chloride, phosphate and fluoride. The harmful substances selected were applied as tracers in the groundwater of a test field as well as in a continuous flow column and partly in batch tests in the laboratory. In the field tests and in the continuous flow column the fluorescent dye Uranin was simultaneously used as a conservative comparative tracer. Thus the migration behaviour of the particular chemical tracer could be detected under the given chemical, physical, biological and hydraulic marginal conditions in the test field and in the column. For most of the substances two or three field tests were carried out with respectively different concentrations. The tracer input concentrations were varied according to the expected dilution, the detection limit and the particular subsoil pollution. Well water-soluble tracer compounds were used as labelling material. Altogether 19 field tests, 24 column tests and 24 batch tests were carried out in order to evaluate the mobility of the 10 tracers used in the groundwater and in the ventilated laboratory water. (orig./MG).

3541 (PNL–7103) **Survey of Columbia River Basin streams for giant Columbia River spire snail Fluminicola columbiana and great Columbia River limpet Fisherola nuttalli.** Neitzel, D.A.; Frest, T.J. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 59p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90002586. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Surveys have confirmed the survival of both the giant Columbia River spire snail Fluminicola columbiana and the great Columbia River limpet Fisherola nuttalli in the Hanford Reach of the Columbia River, Washington State, as well as other sites in Washington, Oregon, and Idaho. A review of historical collection records suggests that both species exist in still other sites of the Columbia River Basin. At present, there is insufficient information to allow adequate appraisal of either species relative to possible federal or state listing as endangered or threatened species. The results of our studies suggest that additional undiscovered populations of both species exist. There is a relatively good chance that pristine habitat required by spire snails and limpets remains in 37 streams or portions of streams in Washington, Oregon, Idaho, and Montana (British Columbia was considered outside the project scope). For a thorough survey, visits to more than 600 sites will be required. 20 refs., 5 figs., 7 tabs.

5202 Chemicals Monitoring and Transport

Refer also to citation(s) 2069, 2132, 2278, 2417, 2716, 2717, 2718, 2719, 2720, 2721, 2722, 2723, 2752, 2770, 2775, 3234, 3494, 3495, 3496, 3498, 3500, 3572, 3771, 3778, 3791

3542 (AD-A–210641/7/XAB) **Installation-Restoration Program Stage 3. McClellan AFB, California. Remedial investigation/feasibility study ground-water sampling and analysis program, January through March 1989 data summary. Final report, January-March 1989.** Radian Corp., Sacramento, CA (USA). 19 Jun 1989. 145p. Available from NTIS, PC A07/MF A01.

Includes 9 Folders with Charts.

This Data Summary presents the results of ground-water sampling activities conducted on and in the vicinity of McClellan Air Force Base from the sampling period of January through March, 1989. Concentrations of purgeable halocarbons and aromatic compounds detected in 336 wells 26 monitoring wells are located on base in Area A, B, C, D, and adjacent on-base areas and off-base in the Northwest and Southwest areas. There was no detected increase in the areal extent of contaminated ground-water, nor was there any increase in the depth that contaminated ground-water was detected. The Area D extraction system is effectively operating to change hydraulic gradients, so groundwater in Area D flows toward the extraction wells. Contaminant concentrations have decreased in Area D deep zone monitoring wells. Samples from three middle-zone monitoring wells located in Area D also show decreases in contaminant concentration during this sampling period.

Decreasing contaminant concentrations have stabilized in shallow zone monitoring wells located off-base, west of Area D.

3543 (AD-A-211153/2/XAB) **Sediment-water interactions and contaminants in Corps of Engineers reservoir projects. Final report.** Gunnison, D.; Brannon, J.M.; Mills, A.L.; Blum, L.K. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab. Jul 1989. 51p. (WES/TR/E-89-2). Available from NTIS, PC A04/MF A01.

Contaminants in Corps of Engineers (CE) reservoir and waterway projects have caused problems in the past. The potential for these contaminants to cause additional problems has increased as more-sophisticated water-quality sampling programs and analyses have been adopted by field offices. Contaminant sediment-water interactions are major mechanisms determining contaminate levels in project waters and availability to contaminants for biological uptake. This report examines the literature on sediment-water interactions and contaminant processes with respect to the unique conditions present in reservoirs. The report also examines the results of CE District surveys conducted to determine the nature and magnitude of contaminant problems in reservoir projects. Recommendations for future investigations are made based on the frequency of contaminant occurrence in CE projects and the major mechanisms for contaminant interaction with sediment and water.

3544 (AD-A-211198/7/XAB) **Formulation of water-quality models for streams, lakes, and reservoirs: Modeler's perspective. Final report.** Stefan, H.G.; Ambrose, R.B.; Dortch, M.S. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab. Jul 1989. 82p. (WES/MP/E-89-1). Available from NTIS, PC A05/MF A01.

This report gives an overview of process descriptions, assumptions, constraints, and other considerations that enter into the development of deterministic mathematical surface-water-quality models. Modeling of hydrodynamic transport is treated separately for standing waters' (lakes, reservoirs, ponds, and impoundments) and flowing waters (rivers and streams). Some information on sediment transport as it relates to water quality is presented. Models addressing organic wastes and nutrients, synthetic organic chemicals, and metals transport and transformation are addressed in separate sections. The review ends with an outlook towards challenges and possible future developments.

3545 (DOE/ER/60431-3) **Field-flow fractionation in the analysis of energy-related materials: Final report, April 1, 1986-March 31, 1989.** Giddings, J.C. Utah Univ., Salt Lake City, UT (USA). 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60431. Order Number DE90003045. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The achievements of our three-year DOE supported project fall into two main categories. First, field-flow fractionation methodology has been applied to complex samples such as humic substances from a variety of sources and colloidal particles in river water. Second, the FFF methods have been developed and refined with the goal of approaching complex samples. In the final report, we first discuss the basic particle characterization work and then summarize the energy-related applications. The publications are listed which report project results during the support period; they are cited by number in the final report text.

3546 (EGG-M-88376) **Biosorption of molybdenum and chromium.** Pryfogle, P.A.; Maiers, D.T.; Wichlacz, P.L.; Wolfram, J.H. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE90002073. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The effects of metal solution concentration, biomass density, length of exposure time, and pH were determined for biosorption of molybdenum (Mo) and chromium (Cr) by three organisms. Results indicate that it is possible to sorb Mo and Cr from dilute solutions. Differences were observed in the abilities of an organism to sorb Mo and Cr as well as among respective abilities of the three microorganisms. This suggests an inherent selectivity of the organism which may afford the selectivity of the organism which may afford the means to control a sorption-based process. Results also indicate that the metal sorption abilities of these microorganisms depend on duration of exposure, biomass density, solution pH, and the metal concentration of the solution. Each of these parameters suggests an additional means of controlling the sorption process. 20 refs., 6 figs., 3 tabs.

3547 (GAO/RCED-89-38) **Water pollution: More EPA action needed to improve the quality of heavily polluted waters.** General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div. 1989. 51p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

In 1972 the Clean Water Act set the stage for the Environmental Protection Agency and the states to focus on technology-based controls to limit pollutants discharged into bodies of water. Although considerable sewage treatments plant construction has been completed and technology-based standards have been implemented in the states of Region X (Oregon, Washington, Idaho, and Alaska), 602 segments of rivers and streams are water-quality-limited. The states have yet to fully implement the more stringent requirements of the act - the setting of total maximum daily loads. Reasons why states have not implemented the requirements are discussed in this paper.

3548 (HW-32809) **Columbia River situation: A semi-technical review.** Parker, H.M. Hanford Works, Richland, WA (USA). 19 Aug 1954. 10p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90002517. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Declassified 3 May 1989.

Contamination of the Columbia River by reactor effluent has been studied with increasing intensity since the start of the Hanford operations. Enough is known of the various ramifications of this complex problem to identify the salient features. As the problem progressively intensifies, the applicable research programs can be modified to amplify those phases which will become more troublesome. At the present time, the situation involves the disposal of about 8,000 curies of radioactive material per day to the river. In addition to the radiation hazard, there are problems, or potential problems arising from chemical toxicity and from thermal effects in the river. Present analysis at this site indicates that all recognized hazard forms are adequately controlled. Projection into the future indicates an over-all favorable position, with some questionable features of damage to aquatic life and secondary hazard to man through sport fishing. Due to the extreme political sensitivity of the river management, it may be expedient to impose certain controls in the interest of the Commission's and its prime contractors' public relations position, at lower levels than the scientists of the contactors' forces deem to be absolutely necessary. Vigorous small-scale research is currently in progress to develop economical means of avoiding or reducing radioactive waste disposal to the river. Ultimately the solution can be achieved by recirculating cooling systems. It is worthy of note that power-producing reactors at this site would automatically provide this relief. 24 refs., 1 tab.

3549 (PB-89-205611/XAB) **Methods for aquatic toxicity-identification evaluations. Phase 3. Toxicity confirmation procedures. Technical report.** Mount, D.I. National Effluent Toxicity Assessment Center, Duluth, MN (USA). Feb 1989. 28p. (EPA-600/3-88/036). Available from NTIS, PC A03/MF A01.

See also PB-89-207005.

Various procedures are described that provide evidence that the suspected toxicants in effluents are the actual toxicants. These procedures include: correlation, symptoms, relative sensitivity, spiking, mass balance, and miscellaneous procedures.

3550 (PB-89-207005/XAB) **Methods for aquatic toxicity-identification evaluations. Phase 2. Toxicity identification procedures. Technical report.** Mount, D.I.; Anderson-Carnahan, L. National Effluent Toxicity Assessment Center, Duluth, MN (USA). Feb 1989. 32p. (EPA-600/3-88/035). Available from NTIS, PC A03/MF A01.

See also PB-89-125934 and PB-89-205611.

This manual describes test methods that can be used to provide evidence as to whether non-polar organics, ammonia, or cationic

metals cause effluent toxicity. These methods are not intended to be irrefutable evidence but only to be providers of enough evidence to suggest that Phase III, the toxicity confirmation, should be started. Phase III uses available methods to provide adequate evidence that the true cause of toxicity is consistently due to the identified toxicants.

3551 (PB–89-214449/XAB) **Influence of discharge and urbanization on the concentration, speciation, and bioavailability of trace metals in the Raritan River, New Jersey. Final report.** McLaughlin, F.B.; Ashley, G.M.; Renwick, W.H. Rutgers–the State Univ., New Brunswick, NJ (USA). Center for Coastal and Environmental Studies. 1988. 85p. Available from NTIS, PC A05/MF A01.

The Raritan River and its tributaries are a vital drinking water and recreational resource in central New Jersey. These waters also serve as disposal media for municipal and industrial wastes and urban stormwater runoff. Rapid development over the last several decades has intensified the pressures on the quality and use of Raritan waters. The concentration and speciation of ten trace metals (Ag, As, Cd, Co, Cr, Cu, Hg, Ni, Pb, Zn) were investigated in the Raritan Basin. From September 1985 to April 1987, one hundred twenty depth-integrated samples were collected at four locations and analyzed by Direct-Current Plasma Atomic Emission Spectrometry for concentrations of dissolved, particulate-associated, total, and suspended sediment trace metals. The concentrations of trace metals readily available, potentially available, and not available to aquatic and terrestrial biota are also reported. Discharge is the most important factor influencing the concentration and speciation of trace metals in the Raritan River and its tributaries. Seasonal variations affect speciation patterns, but have a minor impact on concentration and availability to biota. The sub-basin draining a more-urbanized area in the Raritan Basin appeared to have elevated concentrations and increased biological availability of trace metals relative to less-urbanized basins.

3552 (PB–89-215552/XAB) **Characterization of year-round sensitivity of California's Montane Lakes to acidic deposition. Final report, October 1986-June 1989.** Sickman, J.O.; Melack, J.M. California Univ., Santa Barbara, CA (USA). Dept. of Biological Sciences. 1 Jun 1989. 116p. Available from NTIS, PC A06/MF A01.

Four high-elevation, lake watersheds in the Sierra Nevada were studied from October 1986 through June 1988. Researchers measured wet deposition, lake outflow and lake chemistry and physics at these sites using the mass-balance approach to relate the effect of wet deposition on lake and stream water chemistry. Crystal and Ruby Lakes, located on the eastern slope of the Sierra, and Topaz and Pear Lakes, located on the western slope in Sequoia National Park, were found to be dimictic. Major solute concentrations in the subsurface reached a minima during the latter part of snowmelt. Near-bottom concentrations of these solutes generally had less seasonal variation and were generally higher than subsurface values. Mean snow depth and chemical concentrations were similar for the winters of 1986-87 and 1987-88 at all watersheds. Volume-weighted mean pH ranged from 5.3 to 5.5, with the dominant ion being hydrogen, ammonium, acetate, nitrate and sulfate. Wet deposition as mixed rain and snow occurring between May and October can deliver more solutes to the watersheds than winter snows.

3553 (PB–89-219539/XAB) **Geographic information system documentation of watershed data for Direct/Delayed Response Project, Southern Blue Ridge Province data base.** Mortenson, D.C. NSI Technology Services Corp., Corvallis, OR (USA). Mar 1989. 34p. Available from NTIS, PC A03/MF A01.

See also PB–89-222483.

The Direct/Delayed Response Project (DDRP) was designed by the U.S. Environmental Protection Agency within the National Acid Precipitation Assessment Program to predict the long-term response of watersheds and surface waters to acidic deposition. The purpose of the DDRP is to investigate and distinguish the time scales over which surface-water systems might change chemically under varying levels of acidic deposition. The DDRP is examining a subset of watersheds sampled as part of the National Surface Water Survey. In the Southern Blue Ridge Province Region of the United States, 35 watersheds are under study. The DDRP required detailed watershed information on those characteristics thought important relative to the effects of acid deposition. The information was then mapped, then entered into a Geographic Information System (GIS). The document discuss protocols, guidelines, and standards used to complete GIS entry of the mapping data, and quality-control procedures were used to ensure accuracy and consistency.

3554 (PB–89-219992/XAB) **In-situ aquifer restoration of chlorinated aliphatics by methanotrophic bacteria. Research report, 1 May 1985-30 April 1989.** Roberts, P.V.; Semprini, L.; Hopkins, G.D.; Grbic-Galic, D.; McCarty, P.L. Stanford Univ., CA (USA). Dept. of Civil Engineering. Jul 1989. 232p. Available from NTIS, PC A11/MF A01.

The project evaluated the potential of enhanced in-situ biotransformation of chlorinated aliphatic solvents by a bacterial community grown on methane under aerobic conditions. The target chlorinated compounds were trichloroethene (TCE), cis- and trans-1,2-dichloroethene (DCE), and vinyl chloride. Laboratory studies were conducted to improve understanding of the microbial growth and transformation rates and to characterize important transport properties. In field experiments, biostimulation was accomplished by introducing methane and oxygen into a shallow, confined, sand and gravel aquifer to encourage the growth of a native bacterial community. Methane utilization commenced within ten days in the first biostimulation attempt, and within one day in subsequent biostimulation episodes. Biotransformation of the target organic compounds ensued immediately after commencement of methane utilization, and reached steady-state values within three weeks. Mathematical modeling of the transport and transformation process confirmed that the behavior observed in the field demonstration was consistent with the results of the laboratory research and theoretical expectations.

3555 (PB–89-222483/XAB) **Geographic information system documentation of watershed data for Direct/Delayed Response Project. Northeast data base.** Mortenson, D.C. NSI Technology Services Corp., Corvallis, OR (USA). Mar 1989. 47p. Available from NTIS, PC A03/MF A01.

See also PB–89-219539.

The Direct/Delayed Response Project (DDRP) was designed by the U.S. Environmental Protection Agency within the National Acid Precipitation Assessment Program to predict the long-term response of watersheds and surface waters to acidic deposition. The purpose of the DDRP is to investigate and distinguish the time scales over which surface water systems might change chemically under varying levels of acidic deposition. The DDRP is examining a subset of watersheds sampled as part of the National Surface Water Survey. In the Northeast Region of the United States, 145 watersheds are under study. The DDRP required detailed watershed information on those characteristics thought important relative to the effects of acid deposition. The information was then mapped, then entered into a Geographic Information System (GIS). The document discusses protocols, guidelines, and standards used to complete GIS entry of the mapping data, and quality control procedures used to ensure accuracy and consistency.

3556 (PB–89-222624/XAB) **Formation and control of nontrihalomethane by-products.** Stevens, A.A.; Moore, L.A.; Miltner, R.J. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1989. 20p. (EPA–600/D-89/037). Available from NTIS, PC A03/MF A01.

Hundreds of organic byproducts of chlorination are now known to occur in drinking water along with the trihalomethanes. About twenty of these appear to be found with sufficient frequency and in sufficient concentration to attract consideration for regulations. These include chloral hydrate, chloropicrin, a trichloropropanone, haloacetonitriles, and haloacetic acids. Trihalomethane concentrations do not serve as good predictors of concentrations of these other byproducts because their conditions of formation vary widely. This is especially true when pH is changed. Treatment strategies for control of these byproducts including the trihalomethanes are: Remove the compounds after they are formed; Remove precursors; and Use other disinfectants. Current evidence supports the idea that precursor removal processes effective for trihalomethane control may be effective for the other byproducts as well.

3557 (PB–89-224455/XAB) **Establishment of a Ground Water Research Data Center for validation of subsurface flow and transport models. Final report, August 1986-November 1988.**

van der Heijde, P.K.M.; Elderhorst, W.I.M.; Miller, R.A.; Trehan, M.F. International Ground Water Modeling Center, Indianapolis, IN (USA). Jul 1989. 238p. Available from NTIS, PC A11/MF A01.

The International Ground Water Modeling Center has established a Groundwater Research Data Center which provides information on research data sets resulting from publicly funded field experiments regarding soil and ground water pollution and related laboratory bench studies, and which distributes selected public domain datasets for testing and validation of models for flow and contaminant transport in the saturated and unsaturated zones of the underground. To fulfill its advisory role, the Data Center analyzes information and documentation resulting from field and laboratory experiments and evaluates the appropriate datasets for their suitability in model testing and validation. The Data Center has developed a computerized data directory, SATURN, programmed independently from any proprietary software. In addition to providing referral services, the Data Center distributes on an as-is basis, selected, high-quality datasets described in the data directory. The datasets of concern represent different hydrological, geological, and geographic-climatic settings, pollutant compositions, and degrees of contamination.

3558 (PB–89-224604/XAB) **Development of an inventory of materials potentially sensitive to ambient atmospheric acidity in the South Coast Air Basin. Final report.** Horie, Y.; Shrope, A.; Ellefsen, R. Valley Research Corp., Van Nuys, CA (USA). Mar 1989. 234p. Available from NTIS, PC A11/MF A01.

An inventory of exposed materials for residential and nonresidential buildings and nonbuildings was developed. The inventory of the residential buildings was developed by conducting telephone surveys of 1,200 households and field surveys of 200 households. The inventory of multi-family residential buildings and nonresidential buildings was conducted by aerial photo analysis. The inventory of nonbuilding materials (infrastructure) was developed by conducting a limited survey and by using engineering calculations. The investigators extrapolated the inventory to the entire using the building-count method.

3559 (PB–89-224695/XAB) **Water resources data for Wisconsin, Water Year 1988. Water-data report (Annual), 1 October 1987-30 September 1988.** Holmstrom, B.K.; Kammerer, P.A.; Erickson, R.M. Geological Survey, Madison, WI (USA). Water Resources Div. May 1989. 439p. (USGS/WRD/HD–89/264). Available from NTIS, PC A19/MF A01.

See also report for 1987, PB–89-130801.

Water-resources data for the 1988 Water Year for Wisconsin include records of streamflow at gaging stations, partial-record stations, and miscellaneous sites; records of chemical, biological, and physical characteristics of surface and ground water. Records of chemical analysis of precipitation, surface and ground water associated with acid deposition are included. In addition, water levels in observation wells are reported.

3560 (PB–89-224885/XAB) **Use of ground-penetrating radar to define recharge areas in the Central Sand Plain. Technical completion report.** Bohling, G.C.; Anderson, M.P.; Bentley, C.R. Wisconsin Univ., Madison, WI (USA). Water Resources Center. 1989. 72p. (WIS-WRC–89-01). Available from NTIS, PC A04/MF A01.

Contamination of ground water by agricultural chemicals in the Central Sand Plain (Portage County in Wisconsin) has prompted studies of ground water flow in the region. Because the ground water system is particularly susceptible to contamination in areas where ground water recharge occurs, identification of recharge zones can contribute significantly to the effective management of agricultural chemical use. An accurate map of water-table elevation (ground water head) is crucial to identifying the distribution of recharge. The reliability of ground-penetrating radar as a total for obtaining high resolution maps of water table elevation was assessed. Sparse subsets of wells in the area were used to calibrate the radar; water-table depths obtained from these calibrations were compared to known water-table depths in the remaining wells. Three wells are the minimum needed to obtain an estimate of uncertainty in calibration parameters; specifically, the radar signal velocity in the subsurface materials and the return time correction factor. If several wells distributed throughout a region of interest yield consistent calibration results, radar can be used to produce a map of water-table elevation for that region.

3561 (PB–89-229819/XAB) **Comparison of bioassays for assessing sediment toxicity in Puget Sound. (Appendices included). Report for 1988-1989 (Final).** Pastorok, R.A.; Becker, D.S. PTI Environmental Services, Bellevue, WA (USA). May 1989. 147p. Available from NTIS, PC A07/MF A01.

This study evaluated the relative performance of several bioassays used to assess toxicity of Puget Sound sediments. Selected bioassays were conducted simultaneously on the same array of sediment samples, and direct comparisons were made among the various tests in relation to specific performance criteria. The bioassays and toxicity endpoints evaluated included the following: Amphipod test (Rhepoxynius abronius), percent mortality and abnormality; Amphipod test (Eohaustorius estuarius), percent mortality and abnormality; Juvenile geoduck (Panope generosa), percent mortality; Juvenile polychaete (Neanthes arenaceodentata), percent mortality and percent reduced biomass; Echinoderm embryo test (Dendraster excentricus), percent developmental abnormality and chromosomal abnormality; Bivalve larvae test (Mytilus edulis, Crassostera gigas), percent abnormal development; Microtox saline and organic extract (Photobacterium phosphoreum), percent decrease in luminescence. The 11 evaluation criteria included: dose responsiveness, sensitivity, statistical power, cost-effectiveness, ecological relevance, ease of use, availability of test organisms, endpoint reliability, relationship to indigenous biota, holding constraints, and stage of protocol development.

3562 (PB–89-865208/XAB) **Water treatment: Air stripping. December 1981-July 1989 (Citations from the Selected Water Resources Abstracts data base). Report for December 1981-July 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 55p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the application of air stripping techniques to water treatment, including ground-water decontamination and waste-water purification. The advantages and disadvantages of air stripping over other water-treatment processes are discussed. Cleanup of the organic emissions generated by air stripping is also considered. The primary applications of air stripping are in ground-water and soil cleanup. Other water treatment processes are discussed in separate bibliographies. (Contains 74 citations fully indexed and including a title list.)

3563 (PB–89-871057/XAB) **Wastewater treatment: Chemical industry. January 1970-September 1989 (Citations from Pollution Abstracts). Report for January 1970-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 95p. Available from NTISPC N01/MF N01.

Supersedes PB–88-869540.

This bibliography contains citations concerning waste-water treatment in the chemical industry relative to a wide variety of industrial pollutants. Biological treatments including carbon additives are described relative to effectiveness. The removal of mercury and its compounds are included, as well as associated problems and recommendations from fertilizer and pesticide pollution. (This updated bibliography contains 250 citations, 16 of which are new entries to the previous edition.)

3564 (PB–89-871339/XAB) **Heavy metals in drinking water: Standards, sources, and effects. January 1978-September 1989 (Citations from the Life Sciences Collection data base). Report for January 1978-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 53p. Available from NTISPC N01/MF N01.

Supersedes PB–88-869664.

This bibliography contains citations concerning the public-health aspects and documented studies of heavy-metal pollutants in drinking water. Topics include human-exposure studies and the toxicological effects incurred by ingestion. Prolonged exposure and quantification factors and effects, federal and state regulations and standards, and laboratory-animal studies are discussed. Sources from landfill contamination of ground water, acid-precipitation contributions to ground water pollution, and corrosion by-products in residential plumbing and public water-supply transport systems are

examined. (This updated bibliography contains 100 citations, 10 of which are new entries to the previous edition.)

3565 (SNV–3593) **Mercury in lake fish. Linkages to mercury and selenium in mor and historical emissions.** Nilsson, Aa.; Andersson, T.; Haakanson, L.; Andersson, A. National Swedish Environmental Protection Board, Solna (Sweden). 1989. 118p. (In Swedish). Order Number DE90719417. Available from NTIS (US Sales Only), PC A06/MF A01.

With 20 p. English summary.

This work has been carried out within a joint mercury project sponsored by some Swedish industries and the National Swedish Environmental Protection Board. The report deals with data from two databases, the first concerns 894 Swedish lakes, the other 363 mor samples. The following parameters are discussed; Hg-, organic and Se-concentrations, Hg- and Se-quantity in mor, Hg- and sulphur deposition from Swedish and continental emissions (point sources and diffuse emissions), precipitation, Hg in pike, lake area, lake mean depth, pH, colour, alkalinity, hardness, sulphur and chloride in lake water. The results are presented in four sections: 1. on geographical variations and statistical correlations for the dose parameters, 2. on lake sensitivity parameters, 3. on the effect parameter FHg, i.e. the Hg-content in 1 kg pike, and 4. on computer simulations to get insights and data on the linkage between various historical Hg-emissions and FHg. There is a long lag phase between emission reduction and reduction of FHg. The known, major Swedish emissions of Hg have already been significantly decreased, but new point sources of Hg have appeared. There has, probably, been a significant change in the character of the Hg-emissions during the last decades. Still, at the present deposition rate, the mercury amount in the Swedish soil systems is probably increasing. High FHg-values in fish in Swedish lakes will be a major environmental problem for decades to come.

3566 (UBA-FB–88-019) **Water quality criteria and management models for the tidal region of the Elbe-River.** Fluegge, G.; Gaumert, T.; Bergemann, M. Arbeitsgemeinschaft fuer die Reinhaltung der Elbe der Laender Hamburg, Niedersachsen und Schleswig-Holstein, Hamburg (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.). Aug 1988. 384p. (In German). Contract UFOPLAN-Nr. 10204337. Available from Copy held by UB/TIB Hannover.

The concentration of several substances, which represent the quality of waters, are varied by hydrological conditions (freshwater discharge) and seasonal influences like temperature, period of vegetation etc. The evaluation of selected quality data of the Elbe-River shows, that a strong functional relation between the parameters and natural influences does not exist. A standardization of quality data, e.g. to a certain hydrological status, as a basis for the development of load plans is not possible. Water quality criteria are presented to valuate the water quality of the tidal region of the Elbe-River, that point out, starting from the natural background as pollution grade Zero, the dimension of anthropogenic pollution by oxygen demanding matters, nutrients, heavy metals and chlorinated hydrocarbons. The defined pollution grades indicate the qualitative and quantitative need of sanitation. For the grading of the heavy metal pollution a standardization to a defined concentration of suspended matter is made. The seasonal development of the oxygen profiles along the estuary ('oxygen depletion' downstream Hamburg) and the needed sanitation steps (different variations of emissions, different preload) are calculated by an oxygen budget model of the tidal region of the Elbe-River. (orig.) With 150 tabs.

5203 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 2183, 2193, 2229, 2539, 3046, 3476, 3477, 3483, 3486, 3503, 3504, 3515, 3548, 3751

3567 (BMU–1989-207) **Accumulation of radionuclides in fish during specified normal operation of nuclear installations and after incidents. Annual report 1987.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Huebel, K.; Litzke, J.; Pawlack, I.; Wolff, S.; Jank-Raff, A.; Steinacker, R.; Gillmeister, H. Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Bayerische Landesanstalt fuer Wasserforschung, Muenchen (Germany, F.R.). 1989. 47p. (In German). Contract BMU St.Sch. 959. Available from Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

The transfer factors for the passage food/body display nuclide-specific but no fish-specific differences. Cs-137 is predominantly taken in via the food, while it is definite that carps take in Sr-85 via the water; trouts on the other hand take it in equally via both paths. According to the same pattern Cyprinidae and Salmonidae take in Zn-65. It seems as if synergistical effects play a role in the accumulation of Mn-54 in the two fish species; carps take in Co-60 via the food; as for trouts no definite statements can be made. The biological half-life values obtained from the simulation of an incident in whose course the state of equilibrium is not reached, differ only slightly from the values calculated for the water respectively food path. The accumulation can be described by a simple differential equation. (orig./HP).

3568 (EPA–520/5-88-018) **Radiological survey of the Mare Island Naval Shipyard, Alameda Naval Air Station, and Hunters Point Shipyard.** Semler, M.O.; Blanchard, R.L. Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility. Jun 1989. 18p. Sponsored by Environmental Protection Agency. Order Number DE89014543. Available from NTIS, PC A03/MF A01; OSTI; US Environmental Protection Agency Office of Radiation Programs, 401 M Street, SW, Washington, DC 20460.

Since 1963, the Eastern Environmental Radiation Facility (EERF), US Environmental Protection Agency (USEPA), in cooperation with the US Naval Sea Systems Command (NAVSEA) has surveyed facilities serving nuclear-powered warships on the Atlantic and Pacific coasts and the Gulf of Mexico. These surveys assess whether the operation of nuclear-powered warships, during construction, maintenance, overhaul, or refueling, have created elevated levels of radioactivity. The surveys emphasize sampling those areas and pathways that could expose the public. In 1984, NAVSEA requested that EPA survey all active facilities serving nuclear-powered warships over the next three years. This report contains the results of surveys conducted at Naval facilities located at Mare Island, Alameda, and Hunters Point in the San Francisco region. The locations of these facilities are shown. 3 refs., 4 figs., 3 tabs.

3569 (IC–89/63) **Current measurement studies around the Cesme Peninsula (Turkey).** Taspinar, N. International Centre for Theoretical Physics, Trieste (Italy). Apr 1989. 15p. Order Number DE90608173. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In order to design coastal structures and marine vehicles safely, it is required to know current climate which shows the variation of the current characteristics with time. There are a wide variety of current meters designed to measure water flow today. Each current meter is capable of recording the influence of mooring arrangement. Here we describe sea water temperatures, salinities and current velocities at offshore of Akburun, Tatlicak Burnu, Kalem Burnu and Kizil Burun areas in Cesme Peninsula 27 August, 1986 to 19 November, 1986. At the end of the investigations, measured significant maximum and average current velocities have been routinely analysed with micro-computers and also the percentages of current velocity have been calculated. (author). 8 refs, 6 figs, 4 tabs.

3570 (NIRS-M–70) **Dynamic aspects of radioactive contamination of marine organisms. Proceeding of the 14th NIRS seminar on environmental research.** Ueda, Taishi (ed.). National Inst. of Radiological Sciences, Chiba (Japan). Nov 1988. 57p. (In Japanese). (CONF-8612177–: 14. NIRS seminar on environmental research, Chiba (Japan), 5 Dec 1986). Order Number DE90719693. Available from NTIS (US Sales Only), PC A04/MF A01.

The report consists of three parts. The first part addresses the kinetics of bioconcentration of chemicals in an aquatic ecosystem. Exponential models are discussed to describe the dynamic aspects of movement (bioconcentration) of a chemical in an aquatic ecosystem. Differential equations for a two-compartment model are solved to relate the movement of a material between fish and water. Similar integrated equations are derived for a three-compartment model. Explanations are made in relation to the concept of the models,

their limitations in application to real ecosystems and bioconcentration factors. The second part deals with sea water exchange. The second reprocessing plant in Japan is being planned to be operational in 1955. A new model is now under development by CRIEPI. For the near-field sea area, a three-dimensional model is applied for predicting the three-dimensional behavior of nuclides. In the far-field area, a two-dimensional model is applied. The two- and three-dimensional models are interfaced to produce a combined model. The third part addresses the field-laboratory comparability. A study is made to estimate the concentration of radionuclides in organisms applying an exponential model which involves the reduction coefficient of radioactivity in sea water together with other biological parameters. The model is successfully applied to the reduction of ^{60}Co with time in brown algae. (N.K.).

3571 (PB–89-210629/XAB) **Radiological surveys of Naval facilities on Puget Sound. Final report.** Lloyd, V.D.; Blanchard, R.L. Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility. Jun 1989. 36p. (EPA–520/5-88/016). Available from NTIS, PC A03/MF A01.

This report presents results of surveys conducted to assess levels of environmental radioactivity resulting from maintenance and operation of nuclear-powered warships at Puget Sound Naval Shipyard, Naval Submarine Base, Bangor, and the proposed Carrier Battle Group Homeporting Site in northwestern Washington. The purpose of the survey was to determine if activities related to nuclear-powered warships resulted in release of radionuclides that may contribute to significant population exposure or contamination of the environment.

5205 Site Resource and Use Studies

Refer also to citation(s) 2079, 2281

3572 (PB–89-220891/XAB) **Final report on the investigation of water purification and waste concentration by the Vacuum Freezing Multiple Phase Transformation Process and its eutectic extension, September 1986-September 1987.** Cheng, C.Y.; Cheng, W.C. Calyxes Research and Development Corp., Albuquerque, NM (USA). 1988. 97p. Available from NTIS, PC A05/MF A01.

This study is a continuation of the study of the Volume Freezing Multiple Phase Transformation (VFMPT) process for desalination and water reuse. During the first grant period, bench-scale experiments were completed for the VFMPT process and initial design of a prototype VFMPT plant was completed. During the course of the second grant, the vacuum freezing and vapor liquefaction operations were tested in a prototype unit referred to as the 40 Inch Long unit. It was concluded that a two rotating screws half submerged in the pool would be a very energy efficient method for providing the necessary surface areas. A flowsheet was developed for the VFMPT plant with detailed mass and energy balances and energy requirements determined.

3573 (PB–89-220941/XAB) **Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report.** Kerfoot, W.B.; Ketchum, B.H.; Kallio, P.; Bowker, P.; Mann, A. Woods Hole Oceanographic Institution, MA (USA). Jan 1976. 92p. (WHOI–76-5). Available from NTIS, PC A05/MF A01.

See also PB–89-220958. Portions of this document are not fully legible.

The Cape Cod Waste-water Renovation and Retrieval System evaluated alternative means of waste-water treatment and developed design criteria for the recharge of water of potable quality to the ground-water reservoir of the coastal outwash plains of Cape Cod and the Islands. The three-year plan involved investigation of the in-situ performance of (1) the existing sand-filter bed at Otis Air Force Base, (2) a rapid infiltration system designed to enhance biological denitrification, and (3) a spray irrigation-cropping program. The quantity and quality of the treated water, the receiving water, and the character of the soil were carefully examined to project eventual water condition after many years of operation.

3574 (PB–89-220958/XAB) **Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report.** Ketchum, B.H.; Vaccaro, R.F.; Kallio, P.E.; Mann, A.; Deese, P.L. Woods Hole Oceanographic Institution, MA (USA). Oct 1976. 140p. (WHOI–76-93). Available from NTIS, PC A07/MF A01.

See also PB–89-220941.

The Cape Cod Waste-water Renovation and Retrieval System evaluated alternative means of waste-water treatment and developed design criteria for the recharge of water of potable quality to the ground-water reservoir of the coastal outwash plains of Cape Cod and the Islands. The three-year plan involved investigation of the in situ performance of (1) the existing sand-filter bed at Otis Air Force Base, (2) selected varieties of animal forage grasses, and (3) various rates of application of secondary effluent. The quantity and quality of the treated water, the receiving water, and the character of the soil were carefully examined to project eventual water condition after many years of operation.

3575 (PB–89-224935/XAB) **Ground-water research: Technical-Assistance Directory.** Environmental Management Support, Silver Spring, MD (USA). 17 May 1989. 49p. Available from NTIS, PC A03/MF A01.

The Directory, a revision of the first edition (EPA/600/9-87/008) published by ORD in March 1987, is intended to foster communication among scientists and engineers throughout EPA's Office of Research and Development (ORD) and among EPA, state, and local personnel involved in the protection and management of ground-water resources. In addition to listing ORD researchers by location and subject matter, the Directory provides brief organizational descriptions of the ground-water research programs for each ORD office. These descriptions may aid in locating assistance in areas not covered by the subject indices.

3576 (PB–89-225585/XAB) **Selection with minimal bias, of an experimental control from natural wetland environments. Technical report (Final).** Tiedemann, R.B. Rutgers–the State Univ., New Brunswick, NJ (USA). 1988. 40p. Available from NTIS, PC A03/MF A01.

The goal of wetland restoration and creation projects is to replicate the native wetland vegetation. The objective evaluation of wetland revegetation, as well as experiments designed to assess the ability of various wetland revegetation methods to replicate the native community, require a representative control site to distinguish between natural variability and that attributable to a treatment. The bias of the investigator often plagues what is intended to be a subjective selection of a control site. This study is designed to census vegetation species compositive of the native community. The study tests the following hypotheses: intentional revegetation as compared to natural colonization will establish a community of vegetation that more closely resembles a native wetland community, and intentional revegetation will establish a community of vegetation more rapidly than natural colonization.

5206 Regulations

Refer also to citation(s) 2764, 2765, 2766, 2767, 2768, 2771, 2772, 2773, 2774, 3518, 3522, 3523, 3524, 3525, 3526, 3527, 3528, 3529, 3530, 3531, 3532, 3533, 3534, 3535, 3547, 3566

3577 (AD-A–210485/9/XAB) **Waste-water characterization survey, Little Rock AFB, Arizona. Final report, 11-24 July 1988.** Scott, S.P. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). May 1989. 44p. (AFOEHL–89-040EQ0109ESC). Available from NTIS, PC A03/MF A01.

The AFOEHL conducted a waste-water characterization survey at Little Rock AFB from 11 to 24 Jul 88. The scope of the survey included characterizing the major sanitary discharges on base and determining whether the waste-water being discharged to the Jacksonville Wastewater Treatment plant violated limits for biochemical oxygen demand and total suspended solids. A total of 26 sampling sites were evaluated. Analytical results showed that discharge standards for biological oxygen demand and total suspended solids were not being exceeded by Little Rock AFB.

3578 (PB–89-218770/XAB) **Translating research into practice: The drinking-water industry.** Clark, R.M. Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab. 1989. 23p. (EPA–600/D-89/014). Available from NTIS, PC A03/MF A01.

The Water Supply Industry is very conservative in adopting major changes in water-supply treatment. An increased number of regulations and an accelerated regulatory agenda has the potential for revolutionizing this field. Technology transfer and information diffusions will be very important in helping the water utilities meet these new regulations. EPA and other agencies are investing heavily in technology transfer. The author suggests a Drinking Water Innovative Technology Program as a mechanism for accelerating information production.

3579 (PB–89-219224/XAB) **Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 11 Jul 1988. 139p. (EPA/ROD/R–02-88/074). Available from NTIS, PC A07/MF A01.

Portions of this document are not fully legible.

The Lipari Landfill site is a municipal- and industrial-waste landfill in Mantua Township, Gloucester County, New Jersey. The landfill consists of an 'onsite' and an 'offsite' portion. This remedial action addresses the offsite portion of the site which is the area outside of the encapsulation system consisting of agricultural and residential areas that include several lakes, streams, and parks. Offsite investigations indicate that lakes, streams, and marshland in the area surrounding the site has been impacted by contaminant migration from the landfill. The primary contaminants of concern affecting the ground water, surface water, sediments, soil and air are VOCs including benzene, toluene, and xylene, and metals including arsenic, chromium, and lead. The selected remedial action for the offsite areas includes: collection of the contaminated ground water/leachate, followed by onsite treatment and discharge to POTW; excavation of contaminated marsh soil, and dredging and dewatering contaminated sediments, followed by thermal treatment and offsite disposal as nonhazardous material; integration of offsite sampling with the onsite monitoring plan being developed to monitor the effectiveness of the onsite flushing action; and temporary remedial measures in the surrounding marshland, if necessary, to mitigate volatile emissions from leachate seepage areas.

3580 (PB–89-219612/XAB) **Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly.** Combs, J.; Koch, D.; Kelley, R.; Smith, L.; Whuk, M. Iowa Dept. of Natural Resources, Des Moines, IA (USA). Jan 1989. 58p. Available from NTIS, PC A04/MF A01.

See also PB–89-219620 and PB–87-178877.

This report, required by the Iowa General Assembly, contains an analysis of the role of ground-water standards in the state's overall ground-water protection efforts. The analysis includes discussion of the historical use of standards for environmental protection, current federal and state programs that use standards, Iowa's current ground-water protection program, and the potential role of standards for ground-water in Iowa. The report makes three specific recommendations on the role of groundwater standards: to continue and enhance the current program of preventing contamination through research, demonstration and education; to adopt cleanup guidelines, based on current EPA lifetime health advisories (for contaminants in drinking water), to direct cleanup of existing areas of contamination; and to require development and implementation of a control strategy for non-point source contamination, in the event voluntary efforts are unsuccessful.

3581 (PB–89-219620/XAB) **Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly. Appendix 2. Written comments.** Iowa Dept. of Natural Resources, Des Moines, IA (USA). Jan 1989. 338p. Available from NTIS, PC A15/MF A01.

See also PB–89-219612.

The report, contains copies of all the written comments and letters received by the Department of Natural Resources during the public comment period on ground-water standards.

3582 (PB–89-220974/XAB) **Supplemental risk-assessment guidance for the Superfund program. Part 1. Guidance for Public-Health Risk Assessments. Part 2. Guidance for ecological Risk Assessments. Draft report (Final).** Environmental Protection Agency, Boston, MA (USA). Region I. Jun 1989. 114p. (EPA–901/5-89/001). Available from NTIS, PC A06/MF A01.

Portions of this document are not fully legible.

This guidance manual was developed to address the practical aspects and issues pertaining to the Superfund risk-assessment process for both public health and environment concerns. Part 1, Guidance for Public Health Risk Assessments, supplements the Superfund Public Health Evaluation Manual and Superfund Exposure Assessment Manual and the Endangerment Assessment Handbook. Explicit guidance on technical matters which should be followed in developing public health risk assessments for EPA Region 1. The guidance addresses hazard identification, dose-response assessment, exposure assessment, risk characterization, and uncertainty/limitations. Part 2 of the manual, Guidance for Ecological Risk Assessments, addresses the collection of site-specific data needed to support an ecological risk assessment, describes a framework for conducting the assessments, and provides several specific approaches for assessing risks to systems exposed to chemical contamination in different media.

3583 (PB–89-224901/XAB) **Performance testing of Method 1312. QA (quality assurance) support for RCRA (Resource Conservation and Recovery Act) testing: Project report.** Chiang, T.C.; Valkenburg, C.A.; Miller, D.A. Lockheed Engineering and Sciences Co., Inc., Las Vegas, NV (USA). Jun 1989. 114p. Available from NTIS, PC A06/MF A01.

The question of how to access the risks associated with ground water contamination from soils containing toxic substances is a critical issue for the Agency. A major limitation of using Method 1310 and 1311 for this purpose is the fact that the sanitary landfill codisposal scenario does not apply to contaminated soils. If these methods are used to assess sites for cleanup purposes, the acetic acid leaching fluid could selectively solubilize toxicants (specifically lead) and incorrectly classify the solid as hazardous when, in fact, no mobilization (leaching) would be expected to occur in the environment. The EPA is considering the use of a newly created synthetic acid precipitation leach test for soils (Method 1312) to provide information about the mobility (leachability) of both organic and inorganic contaminants present in soils.

3584 (PB–89-225486/XAB) **Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 31 Mar 1988. 141p. (EPA/ROD/R–05-88/062). Available from NTIS, PC A07/MF A01.

See also PB–87-189890.

The Forest Waste Disposal site consists of an 11-acre, abandoned municipal and industrial waste landfill and 9 surface impoundments. It is located in Genesee County, Michigan, 20 miles northeast of Flint, and is surrounded by agricultural land and undeveloped woodlands and wetlands. Forest Waste Disposal conducted landfill operations from 1972-1978, receiving limited types of liquid industrial waste, general household refuse, and drummed waste until 1978. Specific waste material found within the landfill includes PBB-contaminated feed, septic sludge, and drums containing primarily solid and liquid VOCs in high concentrations. The primary contaminants of concern affecting the soil and ground water are VOCs including toluene and TCE; other organics including pesticides, PAHs and PBBs; and metals including arsenic and lead. The selected remedial action for the site includes: removal and incineration of contaminated soil; installation of a containment system including a RCRA cap, slurry wall, dewatering system and a leachate collection system; and treatment and disposal of collected leachate; deed restrictions to prevent use of the ground water as a drinking water source; access restrictions; and ground water monitoring.

3585 (PB–89-225643/XAB) **Local government techniques for inland wetlands protection. Technical report.** Anderson, T. Cornell Univ., Ithaca, NY (USA). Dept. of Natural Resources. 1988. 94p. Available from NTIS, PC A05/MF A01.

A fair amount of progress has been made in the area of coastal wetlands protection, but inland wetlands have been given less attention until recently. Except where non-tidal wetlands are large and associated with navigable waters, they have usually been afforded little protection. Since many areas are still in the early stages of inland wetland protection, this report concentrates on examples and techniques for inland circumstances. Most of the strategies discussed, however, could also be applied to coastal wetlands. The report also focuses on the role that local governments can play in the wetland-protection process. The federal and state governments have numerous wetlands-related programs in place, some of which may explicitly involve local governments, and other of which may affect the way the local decision maker chooses to approach the problem. A brief look at all three levels of government may help set the stage for the discussion of the local role, as well as pointing out opportunities for cooperative efforts between the Federal, State, and local levels of government.

3586 (PB–89-229512/XAB) **Superfund Record of Decision (EPA Region 3): Croyden TCE Spill, PA. (First Remedial Action), December 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 28 Dec 1988. 55p. (EPA/ROD/R–03-89/066). Available from NTIS, PC A04/MF A01.

The Croyden TCE Spill site is located in Bristol Township, Buck County, Pennsylvania. VOC contamination in the ground water was detected over a 3.5-square mile area, predominantly residential, with an estimated 3,000 residents. The study area is bordered on the south by the Delaware River. Neshaminy Creek, which borders the study area to the west, and Hog Run Creek which flows through the focused area of investigation, both discharge to the river. Although the source of contamination has not been identified, the contaminant plume appears to be flowing south-southeast into the East Branch of Hog Run Creek and probably into the Delaware River. The primary contaminants of concern affecting the ground water are TCE and PCE. The selected remedial action for the site includes connecting approximately 13 residences to the public water supply system via the construction of new water services lines, mains, hydrants, and valves; and ground water monitoring to ensure that homes located outside of the TCE-contaminated zone will not be at risk from the migrating plume.

3587 (PB–89-229520/XAB) **Superfund Record of Decision (EPA Region 5): Wausau Water Supply, WI. (First Remedial Action), December 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 12 Dec 1988. 78p. (EPA/ROD/R–05-89/086). Available from NTIS, PC A05/MF A01.

Portions of this document are not fully legible.

The Wausau Water Supply site, also known as the Wausau Ground-water Contamination site, encompasses an area in the northern section of the City of Wausau, Marathon County, Wisconsin. The site includes five of six production wells in the City Well Field and is located on both sides of the Wisconsin River. The wells supply nearly all the potable water for approximately 33,000 people, as well as irrigation and industrial water to surrounding areas. In 1982, the city discovered that wells CW3, CW4, and CW6 were contaminated with VOCs. Since that time, several systems have been implemented to reduce VOC levels in the water supply. Initially, uncontaminated water from CW9 and CW7 was blended with water from CW3, CW4, and CW6 to dilute the VOC concentrations. However, increasing VOC concentrations resulted in regulatory limits being exceeded. The primary contaminants of concern affecting the West Well Field at the site are VOCs including TCE. The selected remedial action for the site includes ground-water pumping and treatment using air stripping with discharge to the Wisconsin River; ground-water monitoring; and provision for implementation of an additional extraction well as necessary.

3588 (PB–89-229975/XAB) **Ground water protection efforts in four new england states. Technical report.** Walden, R. Environmental Protection Agency, Washington, DC (USA). Office of Cooperative Environmental Management. 5 Mar 1988. 154p. (EPA–600/9-89/084). Available from NTIS, PC A08/MF A01.

The motivation for the study (a set of four case studies) emanates from the Wellhead Protection (WHP) Program, mandated under Section 1428(e) of the Safe Drinking Water Act Amendments of 1986. The program is intended to protect areas of public water supply from sources of anthropogenic contamination that pose an existing or potential threat to public health. In anticipation of this effort, the study surveys and evaluates local ground water and wellhead protection strategies in representative, but progressive communities in New England: Springfield, Vermont; Topsham, Maine; Merrimack, New Hampshire; North Kingstown, Rhode Island. The case study method is employed on the premise that the lessons drawn from the four communities will be useful to EPA and State agencies in providing guidance to other communities in the region.

3589 (PB–89-233894/XAB) **Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 31 Mar 1988. 71p. (EPA/ROD/R–03-88/045). Available from NTIS, PC A04/MF A01.

See also PB–85-213858.

Tyson's Dump, a 4-acre abandoned septic and chemical-waste disposal site, is located in Upper Merion Township, Montgomery County, Pennsylvania. Several formerly unlined lagoons were used to store various industrial, municipal, and chemical wastes. Spills and overflows reportedly occurred during the period of operation, thus allowing for the dispersal of wastes throughout the site. Surface water runoff and seeps contributed to offsite migration of the wastes toward the Schuylkill River. Immediate removal measures were initiated in January 1983. In December 1984, EPA issued an operable-unit ROD for the onsite area. Remedial actions selected in the ROD include: excavation and offsite disposal of contaminated soils and sediments; and upgrading the existing air strips to treat leachate, shallow ground water, and surface run-on. In the fall of 1985, Ciba-Geigy Corporation (CGC) agreed to conduct a further investigation of the offsite area. In November 1986, CGC initiated an onsite pilot study using an innovative vacuum extraction technology process. In June and July 1987, four responsible parties, CGC, Smith-Kline Beckman, Wyeth Laboratories, and Essex Group submitted an alternative proposal to EPA for the first operable unit cleanup.

3590 (PB–89-235212/XAB) **ROD (Record of Decision) annual report, FY 1988.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. Jul 1989. 495p. (EPA–540/8-89/006). Available from NTIS, PC A21/MF A01.

See also report for FY87, PB–89-114144.

In FY 1988, EPA continued to implement the Superfund Amendments and Reauthorization Act of 1986 (SARA). In the remedial decision-making process, Section 121 of SARA mandates the selection of a remedial action that is protective of human health and the environment. One hundred fifty-two RODs were signed during FY 1988. This represents a 100% increase over FY 1987. Ninety-five of the FY 1988 RODs addressed final source control. The remaining 57 RODs selected ground-water remedies only (39), interim-source control actions (4), or no further action (14). Forty-nine RODs selected both source control and ground water remedies. Consistent with the policy started in FY 1986 to delegate ROD approval authority to the Regions, 99 percent of all FY 1988 RODs were approved at the Regional level.

3591 (PB–89-235279/XAB) **Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action.** Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response. 28 Dec 1988. 98p. (EPA/ROD/R–02-89/077). Available from NTIS, PC A05/MF A01.

The Clothier Disposal site is located in a rural area near the Town of Granby, Oswego County, New York. In 1973, drums of chemical waste were discovered on the Clothier property, despite State denial of a landfill permit application. After the New York Department of Environmental Conservation brought suit, the owner made several attempts to clean up the property. These attempts resulted in drums being broken and drained. Subsequently, additional dumping of roofing materials, household wastes and junked vehicles occurred at the site. Based on the remedial investigation and State sampling, EPA established the need for a removal action for 2,200

drums located onsite. The primary contaminants of concern affecting the soil are VOCs including toluene, xylene, and PCE; other organics including PAHs; PCBs and phenols; and metals. The selected remedial action for the site includes: placement of a one-foot soil cover over the contaminated areas and regrading and revegetation of the site; installation of rip-rap, as needed, on the embankment sloping towards Ox Creek to prevent soil erosion; construction and post-construction air monitoring; institutional controls preventing the utilization of the underlying ground water, or any land use involving significant disturbance of the soil cover; and long-term ground water, soil, sediment and surface water monitoring.

3592 (PB–89-872584/XAB) **Inland wetlands legislation and management. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 116p. Available from NTISPC N01/MF N01.

Supersedes PB–88-866819.

This bibliography contains citations concerning Federal and state laws and management programs for the protection and use of inland wetlands. Utilization of wetlands to control highway runoff and community waste water is discussed. Wetlands protection programs, restoration projects, resource planning, and wetlands identification methods are cited. References to coastal and saltwater wetlands are excluded from this bibliography. (This updated bibliography contains 219 citations, 37 of which are new entries to the previous edition.)

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

3593 (LA–11651-MS) **The degradation of natural resources in the Soviet Union.** Cernicek, M.; Pearse, S.R.; Smith, R.L. Lawrence Livermore National Lab., CA (USA). Sep 1989. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CNSS/Papers–21). Order Number DE90002621. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The cost of natural resources in the USSR is increasing. The authors attribute the increased costs to excessive exploitation of natural resources and the serious degradation of resource quality. 26 refs.

5301 Social and Economic Studies

Refer also to citation(s) 2129, 2130, 2131

5302 Assessment of Energy Technologies

3594 (NUREG–0775-Suppl.) **Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446): Supplement.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. Oct 1989. 11p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

In September 1981, the staff of the Nuclear Regulatory Commission (NRC) issued its Final Environmental Statement (NUREG-0775) related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446), located in Somervell County, Texas, approximately 40 miles southwest of Fort Worth, Texas. The NRC has prepared this supplement to NUREG-0775 to present its evaluation of the alternative of operating Comanche Peak with the installation of further severe-accident-mitigation design features. The NRC has discovered no substantial changes in the proposed action as previously evaluated in the Final Environmental Statement that are relevant to environmental concerns and bearing on the licensing of Comanche Peak Steam Electric Station, Units 1 and 2. 6 refs., 3 tabs.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 2610

5501 Behavioral Biology

3595 (AD-A–210225/9/XAB) **Parallel processing and learning in simple systems. Final report, 10 January 1986-14 January 1989.** Mpitsos, G.J. Oregon State Univ., Newport, OR (USA). Hatfield Marine Science Center. 15 Mar 1989. 6p. Available from NTIS, PC A02/MF A01.

Work over the three-year tenure of this grant has dealt with interrelated studies of (1) neuropharmacology, (2) behavior, and (3) distributed/parallel processing in the generation of variable motor patterns in the buccal-oral system of the sea slug Pleurobranchaea californica. (4) Computer simulations of simple neutral networks have been undertaken to examine neurointegrative principles that could not be examined in biological preparations. The simulation work has set the basis for further simulations dealing with networks having characteristics relating to real neurons. All of the work has had the goal of developing interdisciplinary tools for understanding the scale-independent problem of how individuals, each possessing only local knowledge of group activity, act within a group to produce different and variable adaptive outputs, and, in turn, of how the group influences the activity of the individual. The pharmacologic studies have had the goal of developing biochemical tools with which to identify groups of neurons that perform specific tasks during the production of a given behavior but are multifunctional by being critically involved in generating several different behaviors.

5502 Biochemistry

Refer also to citation(s) 3365, 3371, 3760, 3761, 3794

3596 (AD-A–210399/2/XAB) **Molecular biology and physiology of methanogenic archaebacteria. Annual report, July 1988-June 1989.** Nagle, D.P.; McCarthy, D.; Tanner, R.S. Oklahoma Univ., Norman, OK (USA). Dept. of Botany and Microbiology. 27 Jun 1989. 17p. Available from NTIS, PC A03/MF A01.

Methane-producing archaebacteria are worthy of their novel biology and potential in anaerobic bioprocessing. This work continues to study the biochemistry, genetics, and molecular biology of the thermophilic autotroph Methanobacterium thermoautotrophicum. DNA from antimetabolite-resistant mutant strains was used to transform sensitive recipient cells to resistance, and DNA was cloned into Escherichia coli plasmids. This DNA will be mutated with transposons in the E. coli host, then isolated and used to transform methanogen cells to selectable mutant phenotypes. Mutant strains resistant to purine analogs were used to determine that wild type cells of M. thermoautotrophicum possess an almost complete set of enzymes for uptake, activation, and interconversion of purine bases and nucleosides. These mutants and the information about the pathways will be the basis for generating a genetic map. Metabolic studies of a unique formate auxotroph revealed a new role for this one carbon compound in the anabolic metabolism of this methanogen.

3597 (AD-A–211272/0/XAB) **Binding of adenosine diphosphoribosyltransferase to the termini and internal regions of linear DNAs (deoxyribonucleic acids).** Sastry, S.S.; Buki, K.G.; Kun, E. San Francisco State Univ., CA (USA). 1989. 13p. Available from NTIS, PC A03/MF A01.

Pub. in Biochemistry, Vol. 28, 5670-5680(1989).

Adenosine diphosphoribosyltransferase ADPRT is a specific nuclear protein of higher eucaryotes that has been known primarily as a DNA-dependent enzyme catalyzing the polymerization of ADP-R derived from NAD+ to helical homopolymers that are covalently bound to ADPRT and certain other nuclear proteins. The authors have recently described a second molecular activity of this enzyme that is only secondarily regulated by the metabolic substrate of ADPRT, which is NAD+, and consists of DNA condensation following the binding of ADPRT to certain circular double-stranded DNAs, an activity that is cooperative with histones. In this paper they identify the binding of ADPRT to DNA termini with the aid of specific exonucleases by methods that have been tested in other systems (Riley

& Wientraub, 1978; Vonder Ahe et al., 1985; Slater et al., 1985; Shalloway et al., 1980; Wu, 1985; Elbrecht et al., 1985). On the other hand, the binding of ADPRT to internal regions of certain restricted double-strand DNAs proved to be more discriminating because it depended on the nature of the restricted DNA fragments.

3598 (ANL/PPRNT–89-194) **Induction and repair of DNA strand-breaks in Bacteroides fragilis.** Abratt, V.; Santangelo, J.; Woods, D.R.; Peak, M.; Peak, J. Argonne National Lab., IL (USA). [1989]. 21p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract W-31109-ENG-38. R01-CA37848;R01-CA34492. Order Number DE90003008. Available from NTIS, PC A03/MF A01 - OSTI.

Alkaline sucrose gradient sedimentation was used to investigate the production and repair of strand-breaks in the DNA of a Bacteroides fragilis wild-type strain, a mitomycin C-sensitive mutant (MTC25) and a UV-sensitive mutant (UVS9). Direct UV-induced strand-breakage of B. fragilis DNA was very limited, but irradiation induced metabolically resulted strand-breakage and resynthesis in the wild-type strain under both aerobic and anaerobic conditions. Fifty percent of the strand breaks accumulated under anaerobic conditions were removed during holding in buffer, but under replicating conditions that original high number average molecular weight (M_n) of the DNA was regained. Under anaerobic conditions the UVS9 mutant showed the lowest level of UV-induced strand-breakage whereas in the MTC25 mutant strand-breakage was intermediate between the wild-type and UVS9 strains. Exposure to oxygen induced low levels of direct DNA strand-breaks which were increased by prolonged exposure of the DNA under alkaline conditions. Under aerobic conditions DNA strand-breakage and complete resynthesis occurred in the UV-irradiated wild-type strain.

3599 (ANL/PPRNT–89-198) **Comparison of the production and phenotypic properties of altered hepatocyte foci in rats initiated with diethylnitrosamine neonatally or after partial hepatectomy in early adulthood.** Peraino, C.; Stevens, F.J.; Staffeldt, E.F.; Russell, J.J.; Prapuolenis, A.; Blomquist, J.A.; Carnes, B.A.; Maronpot, R.R. Argonne National Lab., IL (USA). [1989]. 16p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract W-31109-ENG-38. Y01-ES-20091. Order Number DE90003011. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The production and phenotypic properties of altered hepatocyte foci that appear prior to hepatic tumor formation were compared in rats initiated with a single low dose of diethylnitrosamine (DEN, 4 micrograms/g body weight), either neonatally or 24 h after partial hepatectomy at 57 days of age, and subsequently promoted with 0.05% dietary phenobarbital. All rats were killed at 100 days after initiation and their livers were examined for foci exhibiting between one and six histochemical markers as well as for cytomorphological changes detected by hematoxylin and eosin staining. Those foci that were detectable solely by histochemical means were designated hist(+)/morph(–) foci and those that also showed cytomorphological aberrations were classified as hist(+)/morph(+) foci. Frequencies, sizes, and histochemical phenotypes of foci in each of the two classes were determined by computer-assisted image analysis of stained serial sections from frozen livers. The results showed that the foci generated by the neonatal initiation protocol were substantially larger and more abundant than those produced by initiation after partial hepatectomy. Moreover, the focus populations generated by the two initiation systems differed in terms of their histochemical and cytomorphological properties, with the foci from the neonatal initiation protocol exhibiting greater evidence of deviation from normalcy (i.e., having higher proportions of foci with more histochemical markers and cytomorphological changes) than the foci from the partial hepatectomy protocol. 18 refs., 3 tabs.

3600 (BNL–43112) **Amperometric biosensors for glucose, lactate, and glycolate based on oxidases and redox-modified siloxane polymers.** Hale, P.D.; Inagaki, Toru; Lee, Hung Sui; Skotheim, T.A.; Karan, Hiroko I.; Okamoto, Yoshi. Brookhaven National Lab., Upton, NY (USA). [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8909256–1: Symposium on biosensors, Chapel Hill, NC (USA), 7-9 Sep 1989). Order Number DE90002301. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Amperometric biosensors based on flavin-containing oxidases undergo several steps which produce a measurable current that is related to the concentration of substrate. In the initial step, the substrate converts the oxidized flavin adenine dinucleotide (FAD) or flavin mononucleotide (FMN) into the reduced form ($FADH_2$ or $FMNH_2$). Because these cofactors are located well within the enzyme molecule, direct electron transfer to the surface of a conventional electrode does not occur to a measurable degree. A common method of facilitating this electron transfer is to introduce oxygen into the system because it is the natural acceptor for the oxidases; the oxygen is reduced by the $FADH_2$ or $FMNH_2$ to hydrogen peroxide, which can then be detected electrochemically. The major drawback to this approach is the fact that oxidation of hydrogen peroxide requires a large overpotential, thus making these sensors susceptible to interference from electroactive species. To lower the necessary applied potential, several non-physiological redox couples have been employed to shuttle electrons between the flavin moieties and the electrode. For example, sensors based on the ferrocene/ferricinium redox couple and on electrodes consisting of conducting salts such as TTF-TCNQ (tetrathiafulvalene-tetracyanoquinodimethane) have previously been reported. Electron relays have also been attached directly to the enzyme molecule to facilitate electron transfer. More recently, these studies have been extended to include systems where the mediating redox species are covalently attached to polymers such as poly(pyrrole), poly(vinylpyridine), and poly(siloxane). The present paper describes the development of amperometric biosensors based on flavin-containing enzymes and this latter family of polymeric mediators. 9 refs., 5 figs.

3601 **Plant senescence: its biochemistry and physiology.** Thomson, W.W.; Nothnagel, E.A.; Huffaker, R.C. (eds.). 269p. American Society of Plant Physiologists, Rockville, MD (1987). Sponsored by U.S. DOE Energy Research. DOE Contract FG03-85ER13334. From 10. annual symposium in plant physiology: plant senescence: its biochemistry and physiology; Riverside, CA (USA); 6-10 Jan 1987.

Considering the early phylogenetic appearance of functional xylem and phloem elements and the range of senescent processes expressed onto genetically, it becomes apparent that such processes are inextricably linked to the evolution, development, reproduction, form, and function of higher plants. The importance of these senescent processes to man are patently obvious since, in one form or another, these processes provide major sources of wood, fiber, and fuel, and are involved in seed development and grain and fruit ripening. To many, the results of senescent processes also have esthetic value including, for example, the grandeur of a Sequoia, the blaze of colors across a desert landscape covered in the spring by ephermal flowers, or the rich tones and panoramic splendor of a deciduous forest in autumn. Senescent processes are widespread, but varied in kind and degree, ranging from whole plants to individual tissues and cells. This symposium was organized primarily around cellular and biochemical aspects of senescence. A major emphasis was the view that senescent processes, and those which developmentally lead to senescence, are highly regulated with an underlying genetic component. Individual papers were processed separately for the database.

3602 (DOE/ER/13581–3) **Gene-enzyme relationships in somatic cells and their organismal derivatives in higher plants: Progress report, August 1, 1988–July 31, 1989.** Jensen, R.A. Florida Univ., Gainesville, FL (USA). 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER13581. Order Number DE90002544. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A novel natural product structurally related to prephenate and arogenate was isolated from a mutant of Neurospora crassa. This D-β-(1-carboxy-4-hydroxy-2, 5-cyclohexadiene-1-yl)-lactic acid has been given the trivial name of D-prephenyllactate. The new metabolite is even more acid labile than is prephenate and is quantitatively converted to phenyllactate at mildly acidic pH. The structure characterization of prephenyllactate was performed using spectroscopic techniques (ultraviolet, ^1H NMR, ^{13}C NMR, two-dimensional heteronuclear experiments and mass spectrometry). Circular dichroism proved conclusively the R configuration of the asymmetric carbon at

C-8 of prephenyllactate. Enzymatic utilization of prephenyllactate by cyclohexadienyl dehydratase and by cyclohexadienyl dehydrogenase from Klebsiella pneumoniae was demonstrated. 6 refs.

3603 (DOE/ER/60692–2) **Mapping and ordered cloning of the human X chromosome: Progress report, November 1988–October 1989.** Caskey, C.T.; Nelson, D.L.; Ledbetter, D.H. Baylor Univ., Houston, TX (USA). Inst. of Molecular Genetics. Oct 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER60692. Order Number DE90002542. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Progress in this project has continued in several areas. These will each be discussed in detail. Overall, the progress has been excellent, with some of the major goals of the application achieved. The areas currently underway are: (1) The establishment of a large number of cloned DNA segments from the region of the X chromosome retained in the X3000-11.1 cell line, (2) The development and use of a sub-chromosomal localization panel of somatic cell hybrids for mapping cloned probes from the X, (3) The development of Alu PCR as a technique for isolating human-specific DNA from a variety of sources, and (4) The establishment of methods for identification and isolation of expressed sequences.

3604 (PB–89-231773/XAB) **Biotechnology research and development activities in industry: 1984 and 1985. Surveys of Science Resources series.** Chirichiello, J.R. National Science Foundation, Washington, DC (USA). Div. of Science Resources Studies. May 1987. 30p. (NSF–87-311). Available from NTIS, PC A03/MF A01.

The report provides estimates of industry's financing of biotechnology research and development (R&D) by sources of support, by technique, and by application. Also provided are data on the employment of scientists and engineers working on biotechnology R&D projects by field and by technique.

3605 **Control of ATP hydrolysis by ADP bound at the catalytic site of chloroplast ATP synthase as related to protonmotive force and Mg^{2+}.** Du, Z. (Univ. of California, Los Angeles (USA)); Boyer, P.D. *Biochemistry (USA),* 28(2): 873-879 (24 Jan 1989). DOE Contract FG03-88ER13845.

The activation of the ATP synthesis and hydrolysis capacity of isolated chloroplast membranes by protonmotive force is known to be associated with the release of tightly bound ADP from the ATP synthase. The data support the view that the activation requires only those structural changes occurring in the steady-state reaction mechanism. The trapping of ADP released during light activation or the chelation of Mg^{2+} with EDTA effectively reduces the rate of decay of the ATPase activity. When the release of tightly bound ADP and Mg^{2+} is promoted by light activation, followed by immediate dilution and washing to retard the rebinding of the ADP and Mg^{2+} released, the ATPase activity remains high in the dark long after the protonmotive force has disappeared. After the addition of ADP and Mg^{2+} the decay of the ATPase activity has the same characteristics as those of the unwashed chloroplast membrane. The results are interpreted as indicating that both Mg^{2+} and ADP must be present prior to exposure to MgATP for the ATPase to be inhibited. However, in contrast to the isolated chloroplast ATPase, the steady-state activity of the membrane-bound ATPase is not inhibited by excess Mg^{2+}. The replacement of [^{3}H]ADP from catalytic sites during hydrolysis of unlabeled ATP or during photophosphorylation with unlabeled ADP occurs as anticipated if Mg^{2+} and ADP bound at one catalytic site without P_i block catalysis by all three enzyme sites. The inhibited form induced by Mg^{2+} and ADP may occur only under laboratory conditions and not have an in vivo role.

3606 **Transcription of oxygen-regulated photosynthetic genes requires DNA gyrase in Rhodobacter capsulatus.** Zhu, Yu Sheng (Lawrence Berkeley Lab., CA (USA)); Hearst, J.E. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(12): 4209-4213 (Jun 1988). DOE Contract AC03-76SF00098.

The regulation of the photosynthetic genes by DNA supercoiling in Rhodobacter capsulatus has been studied by using gyrase inhibitors in vivo and by measurement of mRNA levels of more than a dozen genes. The results demonstrate that the levels of mRNA for light-harvesting (I,II) and reaction center (L, M, H) proteins, bacteriochlorophyll biosynthetic enzymes, ribulose-bisphosphate carboxylase (EC 4.1.1.39), and the mRNAs from the open reading frames Q and R decreased immediately and dramatically upon addition of novobiocin and coumermycin. In contrast, the mRNAs for carotenoid biosynthetic enzymes, the cytochrome bc_1 complex, and constitutively expressed mRNA under aerobic conditions for light-harvesting I and for reaction center (L, M) proteins are less sensitive to the inhibitors. In accordance with these results, the biosynthesis of bacteriochlorophyll is markedly repressed by gyrase inhibitors novobiocin, coumermycin, nalidixic acid, and oxolinic acid either under anaerobic conditions or during a shift from aerobic to anaerobic conditions. The synthesis of light-harvesting (I, II) bacteriochlorophyll complexes is also inhibited by novobiocin and coumermycin. The kinetics of specific mRNA changes and the differential sensitivity of anaerobic and aerobic genes to the gyrase inhibitors strongly suggest that DNA supercoiling is involved in the differential expression of photosynthetic genes in response to the level of oxygen in R. capsulatus.

3607 **Sequence and nitrate regulation of the Arabidopsis thaliana mRNA encoding nitrate reductase, a metalloflavoprotein with three functional domains.** Crawford, N.M. (Stanford Univ. School of Medicine, CA (USA)); Smith, M.; Bellissimo, D.; Davis, R.W. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(14): 5006-5010 (Jul 1988). DOE Contract FG03-84ER13265.

The sequence of nitrate reductase mRNA from the plant Arabidopsis thaliana has been determined. A 3.0-kilobase-long cDNA was isolated from a λgt10 cDNA library of Arabidopsis leaf poly(A)$^+$ RNA. The cDNA hybridized to a 3.2-kilobase mRNA whose level increased 15-fold in response to treatment of the plant with nitrate. An open reading frame encoding a 917 amino acid protein was found in the sequence. This protein is very similar to tobacco nitrate reductase, being >80% identical within a section of 450 amino acids. By comparing the Arabidopsis protein sequence with other protein sequences, three functional domains were deduced: (i) a molybdenum-pterin-binding domain that is similar to the molybdenum-pterin-binding domain of rat liver sulfite oxidase, (ii) a heme-binding domain that is similar to proteins in the cytochrome b_5 superfamily, and (iii) an FAD-binding domain that is similar to NADH-cytochrome b_5 reductase.

5503 Cytology

3608 (ANL/PPRNT–89-191) **Induction of sister chromatid exchanges by direct and indirect chemical agents in a human teratoma cell line.** Murison, G. Argonne National Lab., IL (USA). [1989]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90003004. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the present work, we have extended the characterization of the P3 cell line, derived from a human epithelial teratocarcinoma, by studying the induction of sister chromatid exchanges (SCEs) by direct and indirect carcinogens. Several direct-acting carcinogens produce a dose-dependent increase in SCEs. Most notably, N-methyl-N′-nitro-N-nitrosoguanidine and 7β, 8α-dihydroxy-9 α,10α-epoxy-7,8,9,10-tetrahydrobenzo(a)pyrene produce increases in SCEs at dosages comparable to those used to induce mutations at the hypoxanthine-guanine phosphoribosyl transferase locus. The indirect carcinogens elicit SCEs only when the P3 cells are cocultured with cells capable of metabolizing the indirect carcinogens to the active form. Human breast carcinoma (BJ-015) and rat hepatoma (RL12) cells are equally efficient in activating polycyclic aromatic hydrocarbons to the active form. This cell-mediated induction of SCEs is obtained when P3 cells are incubated with live, x-irradiated, or UV-irradiated BJ or RL cells. This P3 cell line is thus equally suitable to study the induction of mutations or the induction of SCEs with direct and indirect carcinogens. 35 refs., 3 tabs.

3609 (EGG-M–88477) **Comparison of digestion procedures used for the determination of boron in biological tissues by ICP-AES [inductively-coupled, plasma-atomic emission spectroscopy].** Bauer, W.F.; Miller, D.L.; Steele, S.M. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 4p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8812115–1:

3. Australia/Japan workshop on neutron capture therapy for malignant melanoma, Sydney (Australia), 13-14 Dec 1988). Order Number DE90002004. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A study was designed to identify the most accurate and reliable procedures for the digestion of biological tissues prior to the determination of boron by inductively-coupled, plasma-atomic emission spectroscopy (ICP-AES). The four procedures used in this study were an acid bomb digestion and digestions performed in test tubes using perchloric acid and hydrogen peroxide, nitric acid and hydrogen peroxide, and nitric acid alone. Digestions using nitric acid and hydrogen peroxide and nitric acid alone were performed in a manner analogous to the perchloric acid/hydrogen peroxide procedure. The tissues used in the study were from dogs that had been administered a boron compound ($Na_2B_{12}H_{11}SH$) and included two brain tissues, a liver and a tongue. These tissues were selected in order to eliminate results that may be due to surface spiking only. None of the test tube procedures were successful in completely dissolving the samples, as was evidenced by residual color and a coagulated precipitate. The amount of precipitate was much larger for the brain tissues in all cases. The acid bomb digestion and the perchloric acid/hydrogen peroxide procedures gave comparable boron concentrations for all of the tissues in this study. 2 refs., 1 tab.

5504 Genetics

Refer also to citation(s) 2601, 2602, 3768, 3775, 3776

3610 (AD-A–210231/7/XAB) **Cloning and characterization of the recA gene of Aquaspirillum magnetotacticum.** Berson, A.E.; Hudson, D.V.; Waleh, N.S. SRI International, Menlo Park, CA (USA). Molecular Biology Dept. 1988. 21p. Available from NTIS, PC A03/MF A01.

The recA gene of Aquaspirillum magnetotacticum was isolated from a genomic library and introduced into a recA mutant strain of Escherichia coli K12. The cloned gene complemented both the recombination and DNA repair deficiency of the host and its protein product promoted the proteolytic cleavage of the LexA protein. A protein whose molecular weight is similar to that of the RecA protein of E. coli was associated with the cloned sequence.

3611 (AD-A–210332/3/XAB) **Genetic engineering of single-domain magnetic particles. Progress report, 1 March-15 June 1989.** Waleh, N.S. SRI International, Menlo Park, CA (USA). Molecular Biology Dept. 15 Jun 1989. 5p. Available from NTIS, PC A02/MF A01.

Magnetotactic bacteria selectively synthesize membrane-bound, nanometer-sized, single-domain magnetic particles known as magnetosomes. Because these bacteria have complex nutritional requirements, only one species, Aquaspirillum magnetotacticum has been grown in pure culture. This bacterium produces approximately twenty intracellular magnetic particles per cell of single-domain size. To synthesize these particles, A. magnetotacticum must possess a highly efficient system(s) to remove iron from the environment. To investigate the mechanism of iron uptake and the synthesis of magnetic particles in this microorganism, the author will construct and screen genomic libraries of A. magnetotacticum for the iron-uptake and magnetosome-synthesizing genes. He will also use the available information on the mechanisms of iron uptake in other bacteria to identify and characterize analogous systems, related genes, or homologous sequences in this magnetotactic bacterium. He has determined already that the genes of A magnetotacticum are functionally expressed in E. coli. Furthermore, he has identified in this bacterium a sequence homologous to the tonB gene of E. coli. The tonB gene is known to be required for iron assimilation in enteric bacteria. The long-term goal of this project is to clone the identified genes in a suitable host organisms that would make the large-scale, regulated production of single-domain magnetic particles possible.

3612 (PB–89-223622/XAB) **Utility of short-term tests for genetic toxicity.** DeMarini, D.M.; Lewtas, J.; Brockman, H.E. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 24p. (EPA–600/D-89/061). Available from NTIS, PC A03/MF A01.

By definition, short-term tests (STTs) for genetic toxicity detect genotoxic agents, not carcinogens specifically. However, there is sufficient evidence, based on mechanistic considerations alone, to say that genotoxic agents are potential carcinogens. STTs have high statistical power, are almost always replicated, can be performed rather easily under various sets of experimental conditions, are relatively inexpensive, and detect a variety of endpoints relevant to carcinogenesis. In addition, several STTs have shown considerable utility in evaluating the genotoxic effects of real-world, environmental complex mixtures as well as the antimutagenic effects of various pure compounds and complex mixtures. STTs are likely to continue to be refined, resulting in STTs that are increasingly more relevant to human mutation and disease. Their utility should not be judged solely against the questionable standard of a rodent carcinogenicity assay.

3613 (PB–89-232755/XAB) **Convention on international trade in endangered species of wild fauna and flora. 1987 annual report. Final report.** Fish and Wildlife Service, Washington, DC (USA). Office of Management Authority. 15 Apr 1989. 347p. (FSW/OMA–89/01). Available from NTIS, PC A15/MF A01.

See also PB–89-166680.

Five tables present all reported 1987 data on international trade, involving the United States, in wildlife and plant species listed on the appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Data on species, quantities, countries involved, purpose of trade, and description of products or specimens are provided.

5505 Metabolism

Refer also to citation(s) 2107

5506 Medicine

Refer also to citation(s) 2490

3614 (AD-A–210773/8/XAB) **Robust spatial calibration of a planar positron camera. Final report, October 1985-September 1987.** Weathersby, P.K.; Survanshi, S.S.; Meyer, P. Naval Medical Research Inst., Bethesda, MD (USA). Oct 1988. 29p. (NMRI–88-23). Available from NTIS, PC A03/MF A01.

The planar positron camera is a three-dimensional imaging device with two parallel and planar large crystal detectors. The spatial calibration problem is to define the relation between the raw digitized detector output to a physical coordinate system in the imaged space. In a calibration procedure, a positron point source is placed in a series of known emission locations during data acquisition. Data are then fit to a mathematical model to estimate spatial offsets and gains in the detector. Fitting procedures require some assumptions about error distribution, and the assumption of normally distributed error used in least-squares estimation does not appear suitable for these detectors. In simulated data sets, alternative non-normal distributions (robust estimators) allowed successful recovery of camera spatial parameters even with a few hundred total detected positron emissions. With experimental data, the robust procedures avoided the unreasonable camera performance parameters estimated by least squares.

3615 (BNL–43086) **Neutron capture therapy for melanoma.** Coderre, J.A.; Glass, J.D.; Micca, P.; Fairchild, R.G. Brookhaven National Lab., Upton, NY (USA). [1988]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8802102–6: Workshop on clinical aspects of Boron Neutron Capture Theory (BNCT), Upton, NY (USA), 1-2 Feb 1988). Order Number DE90001331. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The development of boron-containing compounds which localize selectively in tumor may require a tumor-by-tumor type of approach that exploits any metabolic pathways unique to the particular type of tumor. Melanin-producing melanomas actively transport and metabolize aromatic amino acids for use as precursors in the synthesis of the pigment melanin. It has been shown that the boron-containing amino acid analog p-borono-phenylalanine (BPA) is selectively accumulated in melanoma tissue, producing boron concentrations in

tumor that are within the range estimated to be necessary for successful boron neutron capture therapy (BNCT). We report here the results of therapy experiments carried out at the Brookhaven Medical Research Reactor (BMRR). 21 refs., 5 figs., 3 tabs.

3616 (DOE/ER/60561–T1) **New techniques for positron emission tomography in the study of human neurological disorders: Progress report, June 15, 1987–November 15, 1989.** Kuhl, D.E. Michigan Univ., Ann Arbor, MI (USA). Div. of Nuclear Medicine. Nov 1989. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60561. Order Number DE90003375. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This progress report represents a summary of our performance during the two year period following initial start-up of these research activities at Michigan. Productivity has been excellent; already over 47 papers and abstracts have been published or accepted for publication from this still young program. They represent significant contributions to extending the technology of positron emission tomography in the study of human neurological disorders. Our focus is to develop more cost effective and efficient means for producing new functionally specific tracers and simpler, less expensive, means for acquiring and interpreting quantitative data. These improved processes are required for the future growth of PET as a sophisticated research tool and for the transfer of this technology to clinical use. Our approach concentrates on two separate yet related areas, radiosynthesis and data analysis. In subproject 1, Drs. Jewett and Mulholland have introduced innovative methods for improving 11C and 18F synthetic processes. In Subproject 2, Dr. Hutchins has laid the foundations for an objective analysis of the limitations and opportunities for quantifying regional PET data. In Subproject 3, Dr. Koeppe has extended rapid techniques for parameter estimation in kinetic modeling of new ligands. Finally, in Subproject 4, Dr. Frey has applied kinetic analysis to ligand tracing of the cholinergic neurotransmitter system in animal and human brain. These DOE supported studies have direct impact on clinical research here and elsewhere which is expected to improve diagnosis and treatment of degenerative neurological diseases, mental illness and brain tumors. 47 refs., 7 figs., 4 tabs.

3617 (DOE/ER/60634–1) **Theory of RBE: Annual progress report, January 1, 1989–December 31, 1989.** Katz, R. Nebraska Univ., Lincoln, NE (USA). Dept. of Physics. 15 Jul 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60634. Order Number DE90002692. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Improvement in our knowledge of the radial distribution of dose about the path of an energetic heavy ion in different media. We wish to scale our calculated radial dose distribution for liquid water to other media through a simplified model based on the electron density in different media, and in which the parameters of our radial dose expression are, adjusted so that the radial integral of the dose agrees with tabulated values of the stopping power of protons in these media. We have generated an approximation to the radial dose in NaI, LiF, SiO_2, and Si, and have found that our calculation for Si is in reasonable agreement with a Monte Carlo calculation for Si made at Oak Ridge. We have now applied these results to LiF TLD's and to scintillation in NaI(Tl). We intend to apply them to other track phenomena. Our analytic expression for the radial dose distribution is presently segmented into two parts, for very low and for high energy ions. This is because the range energy data for electrons in aluminum falls into two parts, with the range proportional to the electron energy at low electron energies, and varying as the 5/3 power of the energy at higher energies. 22 refs.

3618 (DOE-tr–89-34) **Thiourea derivatives: Process for their production and for their use for neutron capture therapy of malignant melanomas.** (Thioharnstoffderivate: Verfahren zu ihrer herstellung sowie ihre verwendung fuer die neutroneneinfangtherapy von malignen melanomen). USDOE, Washington, DC (USA). 1989. 43p. Translation source information not available. Sponsored by U.S. DOE Management & Administration. Order Number DE90002745. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This invention is concerned with a new kind of thiourea derivative; a process for their preparation, and their use for neutron capture therapy of malignant melanomas. Thiourea derivatives are known as substance which can be selectively accumulated in malignant melanomas, due either to active melanin synthetics or to the presence of melanin. Malignant melanomas are tumors of the melanocytes. Their incidence rate is particularly high in the light-skinned population. The rate is rising in most industrial countries.

3619 (FNAL-TM–1622) **Proton linac for hospital-based fast neutron therapy and radioisotope production.** Lennox, A.J.; Hendrickson, F.R.; Swenson, D.A.; Winje, R.A.; Young, D.E. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1989. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8909244–1: International heavy particle therapy workshop, Villigen (Switzerland), 18-20 Sep 1989). Order Number DE90001875. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Recent developments in linac technology have led to the design of a hospital-based proton linac for fast neutron therapy. The 180 microamp average current allows beam to be diverted for radioisotope production during treatments while maintaining an acceptable dose rate. During dedicated operation, dose rates greater than 280 neutron rads per minute are achievable at depth, DMAX = 1.6 cm with source to axis distance, SAD = 190 cm. Maximum machine energy is 70 MeV and several intermediate energies are available for optimizing production of isotopes for Positron Emission Tomography and other medical applications. The linac can be used to produce a horizontal or a gantry can be added to the downstream end of the linac for conventional patient positioning. The 70 MeV protons can also be used for proton therapy for ocular melanomas. 17 refs., 1 fig., 1 tab.

3620 (IAEA-R–3948-F) **Quality control scheme for thyroid related hormones measured by radioimmunoassay. Final report for the period 1 January 1985 - 1 April 1989.** Kamel, R.S. Iraq Atomic Energy Commission, Baghdad (Iraq). Nuclear Research Centre; International Atomic Energy Agency, Vienna (Austria). Sep 1989. 117p. Order Number DE90608415. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

A regional quality control scheme for thyroid related hormones measured by radioimmunoassay is being established in the Middle East. The scheme started in January 1985, with eight laboratories which were all from Iraq. At the present nineteen laboratories from Iraq, Jordan, Kuwait, Saudi Arabia and United Arab Emirates (Dubai) are now participating in the scheme. The scheme was supported by the International Atomic Energy Agency. All participants received monthly three freeze dried quality control samples for assay. Results for T3, T4 and TSH received from participants are analysed statistically batch by batch and returned to the participants. Laboratories reporting quite marked bias results were contacted to check the assay performance for that particular batch and to define the weak points. Clinical interpretation for certain well defined samples were reported. A regular case study report is recently introduced to the scheme and will be distributed regularly as one of the guidelines in establishing a trouble shooting programme throughout the scheme. The overall mean between the laboratory performance showed a good result for the T4, moderate but acceptable for T3 and poor for TSH. The statistical analysis of the results based on the concept of a "target" value is derived from the believed correct value the "Median". The overall mean bias values (ignoring signs) for respectively low, normal and high concentration samples were for T4 18.0 +- 12.5, 11.2 +- 6.4 and 11.2 +- 6.4, for T3 28.8 +- 23.5, 11.2 +- 8.4 and 13.4 +- 9.0 and for TSH 46.3 +- 50.1, 37.2 +- 28.5 and 19.1 +- 12.1. The scheme proved to be effective not only in improving the overall performance but also it helped to develop awareness of the need for internal quality control programmes and gave confidence in the results of the participants. The scheme will continue and will be expanded to involve more laboratories in the region. Refs, fig and tabs.

3621 (INIS-BR–1734) **Rapid purification of radiodinated glucagon with Sep-Pak^R reversed phase cartridges.** Borghi, V.C.; Nascimento, M.; Wajchenberg, B.L. Sao Paulo Univ., SP (Brazil). Faculdade de Medicina. [1989]. 15p. Order Number DE90608416. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A simple, rapid method is described for the purification of radioiodinated glucagon for use in radioimmunoassay. Samples of the

radioiodinated hormone, before and after purification are analysed on polyacrylamide gel electrophoresis. The ^{125}I incorporation in these samples is also checked through thrichloroacetic acid precipitation. The usefulness of this labeled glucagon in radioimmunoassay is demonstrated by its biding to specific antibodies. (M.A.C.).

3622 (INIS-BR–1737) **Quality control of radioimmunoassay technique for gastrine dosage.** Ginabreda, P.; Borghi, V.C.; Bettarello, A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90608417. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. GASTRIN/radioimmunoassay; GASTRIN; RADIOIMMUNOASSAY; PERFORMANCE TESTING; QUALITY CONTROL

3623 (INIS-BR–1738) **Rapid method for purification of radioiodinated glucagon.** Borghi, V.C.; Nascimento, M.; Marco, L.A.C. de; Wajchenberg, B.L. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90608418. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only.

3624 (INIS-mf–12015) **Design and test of a MR-imager with superconducting magnet. Final report.** Hentschel, D.; Vetter, J. Siemens A.G., Erlangen (Germany, F.R.). Unternehmensbereich Medizinische Technik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Feb 1988. 101p. (In German). Contract BMFT 01 VF042/0. Order Number DE90722246. Available from NTIS (US Sales Only), PC A06/MF A01.

Today magnets with small bores of some centimeters in diameter and flux densities of up to 12 T are used for Magnetic Resonance (MR) examinations of small animals and samples of tissue. To investigate the possibilities of MR imaging and spectroscopy of humans at high flux densities, two superconducting whole-body magnets have been built by the Siemens AG and completed to research-type MR systems. First a 2 T magnet with a 1 m bore and second a 4 T magnet with a 1.25 m bore and a total weight of 10.6 t have been built. With the 2 T system methods for fast imaging (FISP) and precise determination of the longitudenal relaxation time T_1 were developed. For sepctroscopic applications several volume selection techniques were investigated. Phosphorus spectroscopy at the 4 T system demonstrated the gain in signal-to-noise ratio and spectral resolution. Hydrogen imaging of the head at 170 MHz is still possible without image degradation of the RF-field by penetration effects. Sodium imaging at 4 T offers the ability to reduce the measurement time or improve the spatial resolution. The clinical relevance of a 4 T MR-system has still to be investigated. (orig.) With 28 refs., 5 tabs., 60 figs.

3625 (INIS-SU–114) **Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.** Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. 98p. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

This is a collection of abstracts of reports presented at the Fourth Conference of Roentgenologists and Radiologists of Byelorussian SSR held at Grodno, September 8-9, 1988.

3626 (INIS-SU–114, pp. 62-63) **Diagnostic possibilities of MR-tomography in revealing and evaluation of hematoma state.** Belenkov, Yu.N.; Dedina, I.D.; Belichenko, O.I. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. HEMORRHAGE/neoplasms; NEOPLASMS/magnetic resonance; NEOPLASMS/tomography; BLOOD VESSELS; DIAGNOSIS; HEMORRHAGE; NEOPLASMS; TOMOGRAPHY; PATIENTS

3627 (INIS-SU–114, pp. 66-67) **Possibilities of creation of information data bank in roentgenoradiology.** Kratenok, V.E.; Gorel'ko, K.P. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. INFORMATION RETRIEVAL/diagnosis; INFORMATION RETRIEVAL/nuclear medicine; BIOMEDICAL RADIOGRAPHY; DATA COMPILATION; DIAGNOSIS; NEOPLASMS; PATIENTS; RADIOTHERAPY

3628 (INIS-SU–114, pp. 69-70) **Computerized tomography in diagnosis of dystrophic vertebrae lesions.** Petukhov, V.N.; Nikitina, L.I.; Dulub, O.I.; Nikolaev, V.N. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. PATHOLOGICAL CHANGES/diagnosis; VERTEBRAE/computerized tomography; CARTILAGE; MORPHOLOGICAL CHANGES; DIAGNOSIS; PATIENTS; VERTEBRAE

3629 (INIS-SU–114, pp. 71-72) **Use of color interpretation of roentgrams of chest organs.** Rozhkovskaya, V.V.; Sergeeva, I.I. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. BIOMEDICAL RADIOGRAPHY/chest; BIOMEDICAL RADIOGRAPHY/color; CHEST; COLOR; DIAGNOSIS; IMAGE PROCESSING; IMAGES; PATIENTS; RHEUMATIC DISEASES

3630 (INIS-SU–114, pp. 72-74) **Advanced methods of instantaneous zonography of temporal bone pyramids.** Savrasova, N.A. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. BIOMEDICAL RADIOGRAPHY/skull; ANATOMY; SKULL; IMAGES; PATIENTS

3631 (INIS-SU–114, pp. 74-75) **Computerized tomography of spinal cord in contrasting.** Sel'khov, Yu.I.; Pustovojtenko, V.T.; Kandybo, A.A. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. COMPUTERIZED TOMOGRAPHY/contrast media; COMPUTERIZED TOMOGRAPHY/spinal cord; DIAGNOSIS; PATHOLOGICAL CHANGES; PATIENTS

3632 (INIS-SU–114, pp. 85-86) **Methods of improving the quality of examinations in radiodiagnosis.** Rabkin, I.Kh.; Vasil'ev, Yu.D. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and

radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/biomedical radiography; ULTRASONIC WAVES/diagnosis; COMPUTERIZED TOMOGRAPHY; CONTRAST MEDIA; NEOPLASMS; NUCLEAR MEDICINE; PATIENTS; DIAGNOSIS

3633 (INIS-SU–114, pp. 91-93) **Possibilities of stomach X-ray examination in low exposure dose.** Belenkov, V.V.; Pavlovich, V.M.; Rakhmanov, S.K. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. BIOMEDICAL RADIOGRAPHY/radiation doses; STOMACH/biomedical radiography; DIAGNOSIS; IMAGE PROCESSING; IMAGES; PATIENTS; STOMACH

3634 (INIS-SU–114, pp. 64-66) **Method of synchronous determination of linear blood flow time in arteries and veins separately.** Borejsho, D.E.; Zajtsev, V.I.; Rakov, A.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. 1 fig. BLOOD CIRCULATION/diagnosis; BLOOD CIRCULATION/radioactivity; ARTERIES; DIAGNOSIS; RADIOACTIVITY; BLOOD FLOW; INTRAVENOUS INJECTION; RADIOCARDIOGRAPHY; RADIONUCLIDE ADMINISTRATION; VEINS

3635 (INIS-SU–114, pp. 67-69) **Method of plotting the scintigrams of high information value.** Naumenko, A.Z.; Ryabov, O.L.; Sokolov, B.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. IMAGE PROCESSING/scintiscanning; BUILDUP; DIAGNOSIS; EFFICIENCY; SCINTISCANNING; IMAGES; NUCLEAR MEDICINE; PATIENTS; RADIOPHARMACEUTICALS

3636 (INIS-SU–114, pp. 3-4) **Contemporary possibilities of combined treatment of rectum cancer.** Berdov, B.A.; Yurchenko, N.I. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; NEOPLASMS/surgery; DELAYED RADIATION EFFECTS; INTEGRAL DOSES; NEOPLASMS; RADIOTHERAPY; SURGERY; PATIENTS; RECTUM

3637 (INIS-SU–114, pp. 5-6) **Efficiency of larynx cancer radiotherapy in dose multifractionating.** Berezhnov, I.P.; Gorienko, V.V.; Koleda, A.A. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; RADIOTHERAPY/fractionated irradiation; LARYNX; NEOPLASMS; RADIOTHERAPY; PATIENTS; RADIATION DOSES; RADIATION EFFECTS

3638 (INIS-SU–114, pp. 6-8) **Evaluation of radiocurability of small cell pulmonary carcinoma according to full value of local control during radiotherapy in clinic.** Bojko, A.V.; Zvekotkina, L.S.; Frank, G.A. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiosensitivity; CARCINOMAS/radiotherapy; CARCINOMAS; RADIOSENSITIVITY; RADIOTHERAPY; FRACTIONATED IRRADIATION; INTEGRAL DOSES; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES

3639 (INIS-SU–114, pp. 8-9) **Possibilities of radiation and combined therapy in treatment of patients with esophagus cancer.** Gerasimyak, V.G. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; NEOPLASMS/surgery; EARLY RADIATION EFFECTS; ESOPHAGUS; INTEGRAL DOSES; NEOPLASMS; RADIOTHERAPY; SURGERY; PATIENTS; SIDE EFFECTS; SURVIVAL CURVES

3640 (INIS-SU–114, pp. 9-10) **Evolution of radiotherapy methods in breast cancer.** Datsenko, V.S. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. 1 tab. NEOPLASMS/radiotherapy; DELAYED RADIATION EFFECTS; FRACTIONATED IRRADIATION; HYPERTHERMIA; MAMMARY GLANDS; NEOPLASMS; RADIOTHERAPY; PATIENTS; SURGERY

3641 (INIS-SU–114, pp. 11-12) **Radionuclidetherapy of metastases of thyroid cancer to lungs.** Demidchik, E.N.; Kruglova, E.N.; Babich, N.P.; Minajlo, T.I. and others. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. METASTASES/radioimmunoassay; METASTASES/radiotherapy; RADIOTHERAPY/iodine 131; LABELLED COMPOUNDS; LUNGS; METASTASES; RADIOIMMUNOASSAY; RADIOTHERAPY; NEOPLASMS; ORAL ADMINISTRATION; PATIENTS; SURGERY; THYROID

3642 (INIS-SU–114, pp. 12-13) **Radiation response in patients with pulmonary carcinoma during remote gamma therapy by means of dynamic multifractionating.** Dzhevechka, I.I.; Atkochyus, V.B.; Mamontov, V.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation*

action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports. Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; LUNGS/radiation injuries; RADIOTHERAPY/side effects; CARCINOMAS; RADIOTHERAPY; FRACTIONATED IRRADIATION; GAMMA RADIATION; INTEGRAL DOSES; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES

3643 (INIS-SU–114, pp. 14-15) **Prospects for development of radiotherapy of patients with esophagus cancer (role of modifying factors).** Isaev, I.G.; Goldobenko, G.V.; Tkachev, S.I.; Kim, F.P. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; RADIOSENSITIVITY/hyperthermia; RADIOSENSITIVITY/metronidazole; ESOPHAGUS; GAMMA RADIATION; NEOPLASMS; RADIOTHERAPY; PATIENTS; RADIOSENSITIVITY; HYPERTHERMIA; METRONIDAZOLE

3644 (INIS-SU–114, pp. 15-16) **Individualization of preoperative radiotherapy in esophagus cancer.** Kiseleva, E.S.; Zimina, E.S.; Mamontov, A.S. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; RADIOTHERAPY/fractionated irradiation; ESOPHAGUS; NEOPLASMS; RADIOTHERAPY; PATIENTS; SURGERY; SURVIVAL CURVES

3645 (INIS-SU–114, pp. 17-18) **Use of subtotal body irradiation as the first stage of systemic antitumoral therapy of patients with generalized lymphogranulomatosis.** Korytova, L.I.; Shust, V.F.; Il'in, N.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. HODGKINS DISEASE/partial body irradiation; HODGKINS DISEASE/radiotherapy; CHEMOTHERAPY; RADIOTHERAPY; PATIENTS; RADIATION DOSES

3646 (INIS-SU–114, pp. 18-20) **Modification of radiotherapy of patients with 1A-3A stage lymphogranulomatosis.** Krutilina, N.I.; Tarasevich, E.L. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. HODGKINS DISEASE/radiotherapy; RADIOTHERAPY/early radiation effects; RADIOTHERAPY; LYMPH NODES; PATIENTS; RADIATION DOSES

3647 (INIS-SU–114, pp. 20-21) **Potentialities of Simulix-Simtomix complex use for preradiation preparation of patients with lung cancer.** Mamontov, V.V.; Dzhevechka, I.I.; Atkochyus, V.B. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; RADIOTHERAPY/computerized tomography; RADIOTHERAPY/images; CARCINOMAS; RADIOTHERAPY; IRRADIATION PROCEDURES; LUNGS; PATIENTS; IMAGES; RESPIRATORY SYSTEM DISEASES

3648 (INIS-SU–114, pp. 22-23) **15-th experience on application of non-standard dose fractionating in radiotherapy of patients with lung carcinoma.** Muravskaya, G.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; RADIOTHERAPY/fractionated irradiation; BIOLOGICAL EFFECTS; CARCINOMAS; RADIOTHERAPY; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES; SURVIVAL CURVES

3649 (INIS-SU–114, pp. 23-24) **Potentialities of 100 per cent objective effect receiving during chemoradiation therapy of patients with small cell lung carcinoma.** Muravskaya, G.V.; Ulitskij, I.I. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/chemotherapy; CARCINOMAS/radiotherapy; BIOLOGICAL RADIATION EFFECTS; CARCINOMAS; CHEMOTHERAPY; RADIOTHERAPY; DRUGS; FRACTIONATED IRRADIATION; INTEGRAL DOSES; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES

3650 (INIS-SU–114, pp. 25-26) **Quality garantee of radiotherapy of patients with lung cancer.** Mus, V.F. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; RADIOTHERAPY/biological radiation effects; CARCINOMAS; RADIOTHERAPY; INTEGRAL DOSES; IRRADIATION PROCEDURES; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES

3651 (INIS-SU–114, pp. 26-27) **Comparative evaluation of efficiency of radiation and surgecal treatment of microinvasive cervix uteri carcinoma.** Nisenbaum, B.L. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; CARCINOMAS/surgery; CARCINOMAS; RADIOTHERAPY; SURGERY; DELAYED RADIATION EFFECTS; GAMMA RADIATION; INTEGRAL DOSES; PATIENTS; SIDE EFFECTS; UROGENITAL SYSTEM DISEASES

3652 (INIS-SU–114, pp. 27-28) **Thymalin as a factor of homeostasis correction in the process of radiotherapy.** Risin, S.A.; Risina, D.Ya.; Mironova, G.I.; Kagan, L.F. and others. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian).

(CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; PEPTIDES/immunity; RADIOTHERAPY/homeostasis; CHROMOSOMAL ABERRATIONS; MICE; NEOPLASMS; RADIOTHERAPY; PATIENTS; PEPTIDES; IMMUNITY; HOMEOSTASIS

3653 (INIS-SU--114, pp. 29-30) **Intracavitary radiotherapy of malignant tumors of rectum.** Sidorchenkov, V.O.; Martsynskij, Yu.S. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; RADIOTHERAPY/biological radiation effects; IRRADIATION PROCEDURES; NEOPLASMS; RADIOTHERAPY; PATIENTS; RADIATION DOSE DISTRIBUTIONS; RADIATION DOSES; RADIATION INJURIES; RECTUM; SURGERY

3654 (INIS-SU--114, pp. 31) **Radiotherapy in combined treatment of patients with breast cancer of early stages.** Simbirtseva, L.P.; Mus, V.F.; Alekseenko, K.K.; Kaganskij, V.L. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; NEOPLASMS/surgery; BREMSSTRAHLUNG; COBALT 60; ELECTRON BEAMS; MAMMARY GLANDS; MEV RANGE 10-100; NEOPLASMS; RADIOTHERAPY; SURGERY; PATIENTS; RADIATION DOSE DISTRIBUTIONS; RADIATION SOURCES

3655 (INIS-SU--114, pp. 32-33) **Combined treatment of breast cancer.** Firsova, P.P.; Izotova, I.A. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/chemotherapy; NEOPLASMS/radiotherapy; NEOPLASMS/surgery; FRACTIONATED IRRADIATION; INTEGRAL DOSES; MAMMARY GLANDS; NEOPLASMS; CHEMOTHERAPY; RADIOTHERAPY; SURGERY; PATIENTS; RADIATION INJURIES; SURVIVAL CURVES

3656 (INIS-SU--114, pp. 33-35) **Comparative evaluation of efficiency of two methods of preoperative radiotherapy of patients with lung carcinoma.** Chernichenko, A.V.; Pitskhelauri, V.G. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; RADIOTHERAPY/irradiation procedures; CARCINOMAS; RADIOTHERAPY; COMPARATIVE EVALUATIONS; FRACTIONATED IRRADIATION; INTEGRAL DOSES; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES; SIDE EFFECTS; SURGERY

3657 (INIS-SU--114, pp. 35-36) **Change in proliferative activity of squamous cell and adenogenic carcinomas in the process of radiotherapy as a possible radiosensitivity index.** Chissov, V.I.; Polyakov, P.Yu.; Sergeeva, N.S.; Kiseleva, E.S. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; RADIOSENSITIVITY/cell proliferation; BIOLOGICAL LOCALIZATION; BIOPSY; FRACTIONATED IRRADIATION; GROWTH; MORPHOLOGICAL CHANGES; NEOPLASMS; RADIOTHERAPY; PATIENTS; RADIOSENSITIVITY

3658 (INIS-SU--114, pp. 36-37) **Basis for use of combined treatment of patients with corpus uteri carcinoma including preoperative irradiation.** Shalkovskij, I.I. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; CARCINOMAS/surgery; BIOLOGICAL EFFECTS; CARCINOMAS; RADIOTHERAPY; SURGERY; GAMMA RADIATION; INTEGRAL DOSES; IRRADIATION PROCEDURES; PATIENTS; UROGENITAL SYSTEM DISEASES; UTERUS

3659 (INIS-SU--114, pp. 43-44) **Influence of local UHF-hyperthermia on frequency of postradiation larynx chondroperichondrites.** Vakker, A.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. LARYNX/radiation injuries; NEOPLASMS/chemotherapy; NEOPLASMS/hyperthermia; NEOPLASMS/radiotherapy; RADIOTHERAPY/side effects; CARTILAGE; GAMMA RADIATION; INTEGRAL DOSES; LARYNX; NECROSIS; NEOPLASMS; CHEMOTHERAPY; HYPERTHERMIA; RADIOTHERAPY; PATIENTS

3660 (INIS-SU--114, pp. 44-46) **Methods of prophylaxis of local radiation injuries based on use of radiobiological models.** Zholkiver, K.I.; Zevrieva, I.F. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. 1 tab. DOSE-RESPONSE RELATIONSHIPS/biological models; DOSE-RESPONSE RELATIONSHIPS/rbe; RADIOTHERAPY/radiation injuries; RADIOTHERAPY/side effects; RBE; FRACTIONATED IRRADIATION; NEOPLASMS; PATIENTS; PLANNING; RADIOSENSITIVITY; RADIOTHERAPY; TEMPORAL DOSE DISTRIBUTIONS

3661 (INIS-SU--114, pp. 48-49) **Peculiarities of surgical treatment of patients with radiation injuries.** Kovalev, A.I.; Tishenko, N.A. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. RADIATION INJURIES/plastic surgery; RADIOTHERAPY/neoplasms; RADIOTHERAPY/side effects; BIOLOGICAL LOCALIZATION; DELAYED RADIATION EFFECTS; PATIENTS; RADIATION DOSES; RADIOTHERAPY; NEOPLASMS

3662 (INIS-SU–114, pp. 50) **Injuries of healthy tissues in nontraditional regimen of dose fractionating in patients with cervix uteri carcinoma.** Kosenko, I.A. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/fractionated irradiation; CARCINOMAS/radiotherapy; RADIATION INJURIES/tissues; RADIOTHERAPY/side effects; CARCINOMAS; RADIOTHERAPY; INTEGRAL DOSES; PATIENTS; TISSUES; UROGENITAL SYSTEM DISEASES

3663 (INIS-SU–114, pp. 53-54) **Immediate results of concomitant radiotherapy of advanced forms of cervix uteri carcinoma with the use of thymaline.** Nikolaeva, D.V.; Khavinson, V.Kh. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/chemotherapy; CARCINOMAS/immunotherapy; CARCINOMAS/radiotherapy; RADIATION INJURIES/early radiation effects; CARCINOMAS; CHEMOTHERAPY; IMMUNOTHERAPY; RADIOTHERAPY; DRUGS; PATIENTS; UROGENITAL SYSTEM DISEASES

3664 (INIS-SU–114, pp. 57-58) **Local complications of radiotherapy in macrofractionated irradiation of patients with larynx cancer.** Puchinina, E.A.; Vakker, A.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/fractionated irradiation; NEOPLASMS/radiotherapy; RADIOTHERAPY/radiation injuries; RADIOTHERAPY/side effects; DELAYED RADIATION EFFECTS; GAMMA RADIATION; INTEGRAL DOSES; LARYNX; METASTASES; NEOPLASMS; RADIOTHERAPY; PATIENTS

3665 (INIS-SU–114, pp. 60-61) **Immunologic status of patients with epidermoid lung cancer in radiotherapy on split course and chemoimmunotherapy.** Shevko, V.A.; Risina, D.Ya.; Muravskaya, G.V.; Artemova, N.A. and others. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/chemotherapy; CARCINOMAS/immunotherapy; CARCINOMAS/radiotherapy; RADIATION INJURIES/immunosuppression; CARCINOMAS; CHEMOTHERAPY; IMMUNOTHERAPY; RADIOTHERAPY; FRACTIONATED IRRADIATION; IMMUNITY; INTEGRAL DOSES; LUNGS; LYMPHOCYTES; PATIENTS; IMMUNOSUPPRESSION; RESPIRATORY SYSTEM DISEASES

3666 (INIS-SU–114, pp. 75-76) **Thermoradiotherapy of patients with recurrences of rectum cancer.** Goldobenko, G.V.; Knysh, V.I.; Kim, F.P.; Tkachev, S.I. and others. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/hyperthermia; NEOPLASMS/radiotherapy; BIOLOGICAL RADIATION EFFECTS; GAMMA RADIATION; INTEGRAL DOSES; NEOPLASMS; HYPERTHERMIA; RADIOTHERAPY; PATIENTS; RECTUM; SURGERY

3667 (INIS-SU–114, pp. 78-79) **Results of combined treatment of patients with pulmonary carcinoma using artificial hyperglycemia.** Zhakov, I.G.; Fradkin, S.Z.; Zhavrid, Eh.A.; Zharkov, V.V. and others. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/hyperglycemia; CARCINOMAS/radiotherapy; CARCINOMAS; HYPERGLYCEMIA; RADIOTHERAPY; EARLY RADIATION EFFECTS; GAMMA RADIATION; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES; SURGERY

3668 (INIS-SU–114, pp. 79-80) **Modifying action of gaseous hypoxia in radiotherapy of pulmonary cancer.** Medvedev, V.N. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/anoxia; CARCINOMAS/radiotherapy; CARCINOMAS; ANOXIA; RADIOTHERAPY; LUNGS; PATIENTS; RADIATION INJURIES; RESPIRATORY SYSTEM DISEASES

3669 (INIS-SU–114, pp. 80-81) **Peculiarities of testing and introduction into clinical practice of Selectron installation in Research Institute of Health Ministry of Byelorussian SSR.** Okeanova, N.I. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; IRRADIATION DEVICES/radiotherapy; BYELORUSSIAN SSR; CARCINOMAS; RADIOTHERAPY; CESIUM 137; GAMMA RADIATION; PATIENTS; UROGENITAL SYSTEM DISEASES

3670 (INIS-SU–114, pp. 82-83) **Clinical experience of application of automated radiotherapy with the use of optimized computer programs.** Pavlov, A.S.; Kostromina, K.N.; Fadeeva, I.A.; Stiop, L.D. and others. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. RADIOTHERAPY/computer calculations; RADIOTHERAPY/programming; NEOPLASMS; PATIENTS; RADIOLOGY; RADIOTHERAPY; PROGRAMMING

3671 (INIS-SU–114, pp. 83) **Program of accelerated plotting the isodose distribution in computer planning of gamma therapy of malignant tumors.** Parakhnevich, V.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.
AT-11764.
Short note. RADIOTHERAPY/isodose curves; RADIOTHERAPY/neoplasms; COMPUTER CALCULATIONS; GAMMA RADIATION; PATIENTS; RADIATION DOSE DISTRIBUTIONS; RADIOTHERAPY; NEOPLASMS

3672 (INIS-SU–114, pp. 84-85) **Assessment of time of programmed irradiation in the case of malignant tumors.** Pilyavets, V.O.; Tarutin, I.G. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.
AT-11764.
Short note. RADIOTHERAPY/optimization; NEOPLASMS; PATIENTS; RADIATION DOSE DISTRIBUTIONS; RADIATION DOSES; RADIOTHERAPY; OPTIMIZATION

3673 (INIS-SU–114, pp. 88-89) **Research in photon irradiation dose fields forming by wedgeshaped filters.** Strakh, A.G.; Arutyunyan, L.G. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.
AT-11764.
Short note. RADIOTHERAPY/dose-response relationships; ISODOSE CURVES; MATHEMATICAL MODELS; NEOPLASMS; PATIENTS; PHOTON BEAMS; RADIATION DOSES; RADIOTHERAPY

3674 (INIS-SU–114, pp. 89-90) **Radioactive colloid gold ^{198}Au in combined treatment of lung cancer.** Yas'kevich, L.S. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.
AT-11764.
Short note. CARCINOMAS/radiocolloids; CARCINOMAS/radiotherapy; CARCINOMAS/surgery; GOLD 198/intravenous injection; CARCINOMAS; RADIOCOLLOIDS; RADIOTHERAPY; SURGERY; DELAYED RADIATION EFFECTS; FRACTIONATED IRRADIATION; INTERNAL IRRADIATION; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES

3675 (INIS-SU–116/A, pp. 43-45) **Radiation changes following treatment of inoperable locally disseminated mammary gland neoplasms when using proton beams.** Monzul', G.D. (Akademiya Meditsinskikh Nauk SSSR, Moscow (USSR). Onkologicheskij Nauchnyj Tsentr); Ratner, T.G. Akademiya Meditsinskikh Nauk SSSR, Obninsk (USSR). Nauchno-Issledovatel'skij Inst. Meditsinskoj Radiologii. 1988. (In Russian). (CONF-8806432–: All-Union conference on local radiation damage diagnostics and treatment, Obninsk (USSR), 28-29 Jun 1988). In *Diagnosis and treatment of local delayed radiation injuries. Summaries of reports.* Order Number DE90705925. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
TB-02620.
Short note. NEOPLASMS/radiotherapy; INTEGRAL DOSES; LYMPH NODES; MAMMARY GLANDS; METASTASES; NEOPLASMS; RADIOTHERAPY; PATIENTS; PROTON BEAMS

3676 (LA-UR–89-2000) **Los Alamos Science: AIDS research.** Cooper, N.G.; Eckhardt, R. Los Alamos National Lab., NM (USA). 1989. 109p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-48. Order Number DE90002637. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.
This document contains a summary of AIDS-related research being conducted at the Los Alamos National Laboratory. Topics include mathematical models of AIDS epidemiology, risk assessment models for various human populations, baseline studies of the virus, and aspects of viral infectivity. (TEM)

3677 (LBL–27919) **Treatment planning for stereotactic heavy-charged particle radiosurgery of the brain.** Frankel, K.A.; Phillips, M.H.; Lyman, J.T.; Chuang, F.Y.S.; Fabrikant, J.I.; Levy, R.P.; Rosander, K. Lawrence Berkeley Lab., CA (USA). Sep 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8905227–3: International conference on radiosurgery a neurosurgical approach to intracranial lesions, Charlottesville, VA (USA), 1-5 May 1989). Order Number DE90003275. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.
Treatment planning techniques for stereotactic charged particle (helium ion) Bragg peak radiosurgery of intracranial vascular and other disorders are described. Stereotactic neuroradiological procedures (cerebral angiography, x-ray computed tomography (CT) and magnetic resonance image (MRI) scanning) define precise intracranial treatment targets on axial, and reformatted coronal and sagittal CT slices. For a given target, beam ports are selected, and aperture size and shape, ranges, compensation, and Bragg peak spread are determined using interactive computer programs. Beam ports are selected to protect critical and sensitive brain structures, or to minimize radiation dose to adjacent normal brain, while delivering a uniform dose distribution through out the target volume. Two-dimensional isodose treatment plans are generated by computer for each CT slice of interest on a pixel-by-pixel basis. Three-dimensional, CT-based treatment planning is developed for specialized clinical uses. In conjunction with dose-volume histograms, three-dimensional plans provide a method for comparing treatment plans of differing radiation modalities, i.e., photons, protons, and heavy charged particles. Treatment plans are presented for a range of intracranial target volumes. 9 refs., 3 figs.

3678 (PB–89-216204/XAB) **Technique for chest radiography for pneumoconiosis.** Sargent, E.N. American Coll. of Radiology, Chicago, IL (USA). 1982. 148p. Available from NTIS, PC A07/MF A01.
Routine radiographic chest examinations have been performed using a variety of techniques. Although chest radiography is one of the most commonly performed radiographic examinations, it is often difficult to obtain consistently good quality roentgenograms. This publication provides a simple guide and relatively easy solution to the many problems that radiologic technologists might encounter. The language is purposely relatively simple and care has been taken to avoid difficult mathematical and physical explanations. The intent is to provide an easily referrable text for those who may encounter difficulties in producing acceptable chest radiographs.

3679 (PB–89-221139/XAB) **Handbook of selected tissue doses for projections common in diagnostic radiology.** Rosenstein, M. Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health. Dec 1988. 71p. (HHS/PUB/FDA–89-8031). Available from NTIS, PC A04/MF A01.
Supersedes PB–257-482.
This handbook provides data for estimating the radiation doses absorbed by various tissues depending on the projection used in diagnostic radiology. The effect of dosage changes on tissues can be evaluated from the material. Variations due to anthropometric characteristics of the human body and its organs are not considered.

3680 (UCRL–100702) **Radiation damage and its influence on source requirements for high resolution x-ray holography.** London, R.A. Lawrence Livermore National Lab., CA (USA). [1989].

8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8905192–2: Conference on X-ray microimaging for the life sciences, Berkeley, CA (USA), 24-26 May 1989). Order Number DE90002508. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Soft x-ray holography offers the possibility of obtaining high resolution, 3-D images of living cells and organelles therein. To achieve a specified resolution, a certain number of photons must be scattered by the smallest features of interest within the sample. This requires a certain irradiating fluence, the magnitude of which depends on the wavelength of the x rays and the scattering cross- sections of the features. Unfortunately, irradiation of the sample will be accompanied by the absorption of x rays. If the dose is large, the sample will be damaged, possibly compromising the quality of the image. A theoretical study of the scattering and absorption of x rays during the creation of a hologram is described. Using a new prescription for scattering by condensed biological materials (e.g., protein and/or DNA) within the aqueous environment of a cell, we estimate the irradiating fluence required for a certain resolution and the associated sample dose. The relative merits of different x-ray wavelengths are discussed. A wavelength of about 44Å, just outside the "water window" (23.2–43.7Å), appears to be optimal in that the required fluence and dose are minimized, while reasonable x-ray penetrability is maintained. Estimates are given for the minimum source energy required and the maximum duration of an exposure to capture an image before blurring due heat induce motion. The use of colloidal gold tagging can enhance image contrast and reduce the required irradiating fluence and sample damage. 6 refs., 5 figs.

3681 **Positron emission tomography of the lung.** Schuster, D.P. (Dept. of Internal Medicine, Washington Univ., Medical School, St. Louis MO); Green, M.A. pp. 385 of Pulmonary nuclear medicine. Loken, M.K Appleton and Lange, E Norwalk, CT (1987).

The major function of the lung is to exchange the respiratory gases, and carbon dioxide. This vital process is accomplished through the regional matching of ventilation to perfusion. Much of what they know in this area has been the result of semiquantitative studies using radiopharmaceuticals and external radiation counting techniques. These approaches have been less successful when applied to disease states because accurate quantitative regional measurements have been difficult to obtain in such circumstances. This paper discusses the development of positron emission tomography (PET), an important technological step forward in resolving these differences in regional function. To date, most of the experience with PET has come from neurological and cardiovascular applications. Its application to lung physiology is just beginning, but the ability to measure ventilation, perfusion, vascular permeability, extravascular water, and metabolism-accurately and repetitively on a regional level-will undoubtedly provide important new information.

3682 **Antigen-specific composition and in-vivo methods for detecting and localizing an antigenic site and for radiotherapy.** Larson, S.M.; Finn, R.; Carrasquillo, J.A. To Department of Health and Human Services, Washington, DC (US). USA Patent Application 7-386,095. 28 Jul 1989. 39p. Available from NTIS, PC A03/MF A01.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of application available NTIS.

The in-vivo method of radiotherapy directed to an antigenic site comprises administering to a subject in need of the therapy an amount of the antigen-specific composition in a dose that will reduce the size of a tumor associated with the antigen. The in-vivo method for detecting and localizing an antigenic site in a subject in need of such detection comprises administering an amount of the antigen-specific composition of the invention effective to localize the antigen-antibody binding site and scanning the subject's body with a positron-emitter (PET) detector to attain the localization of the site. The in-situ method of radiotherapy directed to an antigenic site in a subject in need of such therapy comprises detecting and localizing the site by the in-vivo method described above followed by PET.

5507 Microbiology

Refer also to citation(s) 2058, 2062, 2107, 2114, 3602

5508 Morphology

3683 **Analysis of cell lineage during early mouse embryogenesis.** Pedersen, R.A. (California Univ., San Francisco, CA (USA). Lab. of Radiobiology and Environmental Health). pp. 359 of Developmental toxicology: Mechanisms and risk. McLachlan, J.A.; Pratt, R.M.; Markert, C.L. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). DOE Contract AC03-76SF01012.

The analysis of cell lineage in early mouse embryogenesis has been undertaken using microinjected lineage tracers. This approach reveals the fate of individual or pairs of sister progenitor cells in the intact preimplantation or early postimplantation embryo. The authors' results indicate that the inner cell mass of the mouse embryo is established during the fourth and fifth cleavage divisions and that all remaining outer cells contribute to the trophectoderm. Their results do not, however, support the idea that trophectoderm and inner cell mass are mutually exclusive clonal entities at the blastocyst stage. The authors find that inner cells contribute to the polar trophectoderm during blastocyst growth. An analysis of cell fate in the early postimplantation endoderm, using this approach, indicates that individual embryonic endoderm cells labeled at mid- or late-primitive-streak stages contribute descendants either to extraembryonic visceral endoderm or to endoderm lining the embryonic gut, but rarely to both tissue populations.

5509 Pathology

Refer also to citation(s) 3786, 3787

5520 Public Health

Refer also to citation(s) 2050, 3403, 3428, 3433, 3434, 3456, 3457, 3458, 3459, 3676, 3770, 3772, 3773, 3777

3684 (PB–89-230239/XAB) **Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication.** Millar, J.D.; Niemeier, R.W.; Reed, L.D.; Johnson, D.L.; Ahlers, H.W. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 6 Dec 1988. 8p. Available from NTIS, PC A02/MF A01.

The testimony was presented in support of earlier information concerning OSHA's final rule to extend coverage of the Hazard Communication Standard to those workers in nonmanufacturing employment as well as those employed in the manufacturing sector. The concept of hazard communication in the workplace was fully supported by NIOSH. It would be desirable to achieve uniformity in the design of and information contained on labels generated by the various industries. One general concern about the OSHA rule was the lack of detailed guidelines on scientific criteria for making the determination of whether a substance is hazardous. The efforts of NIOSH which would be useful as a source of information in determining hazards were again cited. NIOSH agreed with OSHA's view that the extent of risk or size of employer should not be determining factors with regard to a decision as to whether the information must be conveyed. Consumer products used in an industrial setting may carry hazards beyond those anticipated in the home and should also be covered in the label requirements. Material-safety data sheets would provide a base determination of hazard potential and enhance the ability of both employers and workers to identify hazardous chemicals.

3685 (PB–89-865182/XAB) **National Institute for Occupational Safety and Health (NIOSH): Health Hazard Evaluation Reports. January 1987-September 1989 (Citations from the NTIS data base). Report for January 1987-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 215p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning health-hazard evaluation investigations performed by the National Institute for Occupational Safety and Health (NIOSH). Specific industrial-location inspections performed by NIOSH as routine surveys or as a result of a health-related complaint are presented. A majority of the citations evaluate potential exposure to toxic materials or hazardous working conditions. Other occupational-health issues are discussed

in separate bibliographies. (Contains 385 citations fully indexed and including a title list.)

5530 Agriculture and Food Technology

Refer also to citation(s) 3789

3686 (INIS-BR–1735) **Bud irradiation to obtain resistence to citrus canker through induction of mutation.** Menten, J.O.M.; Pompeu Junior, J.; Dragone, P.; Sobrinho, J.T.; Prada, V.A.; Tulmann Neto, A.; Ando, A. Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil). [1989]. 9p. (In Portuguese). Order Number DE90608255. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The radiosensitivity to gamma rays of the bud of the orange cultivar Pera is determined through irradiation of buds with several doses; the irradiated buds were grafted onto rootstocks of lemon cu. Cravo. The grafting percentage and the development of the V_1 stem from the irradiated buds are analysed; it is concluded that the best dose for induction of mutation is 4,0 OK. New buds are irradiated and grafted with this dose. The V_1 stems are Separeted into 3 Groups, according to the position of the buds on the stem. The V_2 stems are analysed according to the morphological alteraTions due to irradiation. (M.A.C.).

3687 (INIS-mf–11543(No.1)) **Activities of the Entomology Unit. Report No.1, 1988.** International Atomic Energy Agency, Vienna (Austria); Food and Agriculture Organization of the United Nations, Rome (Italy). Nov 1988. 75p. Order Number DE90608276. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

This semiannual report describes the activities carried out by the staff of the Entomology Unit at the Agency's Laboratories, Seibersdorf, between 1 January and 31 July 1988. The colonization of Glossina spp. was continued to provide insects for ongoing and anticipated control programmes and supporting research activities. Hybridization of the two subspecies palpalis palpalis (GPP) and palpalis gambiensis (GPG) was studied. Rearing of medfly was studied. Figs and tabs.

3688 (PB–89-860035/XAB) **Food and grain preservation through irradiation. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 156p. Available from NTISPC N01/MF N01.

Supersedes PB–88-856372.

This bibliography contains citations concerning the principles, methods, and results of using ionized irradiation to preserve grains and foods through reduction of spoilage and infestation. The citations cover irradiation chemistry as it affects food wholesomeness, nutrition, and changes in food value. Irradiation methods include sources of irradiation, primarily gamma rays, and dosage for specific foods. Many articles reference public health and safety, studies of effect of irradiated food on laboratory animals, and associated standards and legislation. (This updated bibliography contains 338 citations, 13 of which are new entries to the previous edition.)

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 2123, 2193, 2539, 3617, 3642, 3664, 3677, 3686, 3756, 3794

3689 (AD-A–211160/7/XAB) **Gamma-radiation affects active electrolyte transport by rabbit ileum. 2. Correlation of alanine and theophylline response with morphology.** Gunter-Smith, P.J. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1989. 15p. (AFRRI-SR–89-16). Available from NTIS, PC A03/MF A01.

Pub. in Radiation Research, Vol. 117, 419-432(1989).

The response of ileal segments isolated from rabbits to an actively transported amino acid and a secretagogue was evaluated following exposure to 10-Gy whole-body gamma irradiation. The ability of ileal segments to respond to the actively transported amino acid, alanine, was not significantly diminished until 96 h postexposure. Decreased responsiveness to the secretagogue, theophylline, occurred earlier at 72 h. These effects did not appear to be accounted for by decreased food intake of irradiated animals alone. Examination of intestinal morphological changes with respect to these changes in electrolyte transport revealed that decreased amino acid transport coincides with loss of intestinal villi. Although a morphological correlate of decreased secretory response was not as striking as that for absorption, the theophylline response appeared to decline concomitant with the appearance of increased mitotic activity in the intestinal crypts. The result of this study indicate that, following a dose of 10 Gy, the inability of these tissues to respond to amino acids is due to a loss of mature villus absorptive cells subsequent to denudation of the intestinal mucosa. There appeared to be little impairment of cell membrane transport processes for alanine. In contrast, the decreased secretory response could not be correlated with the disappearance of any one cell type and perhaps results from increased proliferation in the crypts at the expense of differentiation.

3690 (AD-A–211185/4/XAB) **Effect of gamma radiation on DNA methylation.** Kalinich, J.F.; Catravas, G.N.; Snyder, S.L. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1989. 14p. (AFRRI-SR–89-19). Available from NTIS, PC A03/MF A01.

Pub. in Radiation Research, Vol. 117, 185-197(1989).

The effect of ^{60}Co gamma radiation on DNA methylation was studied in four cultured cell lines. In all cases a dose-dependent decrease in 5-methylcytosine was observed at 24,48, and 72 h postexposure to 0.5-10 Gy. Nuclear DNA methyltransferase activity decreased while cytoplasmic activity increased in irradiated (10 Gy) V79A03 cells as compared to controls. No DNA demethylase activity was detected in the nuclei of control or irradiated V79A03 cells. Additionally gamma radiation resulted in the differentiation of C-1300 N1E-115 cells, a mouse neuroblastoma line, in a dose- and time-dependent manner. These results are consistent with the hypothesis that (1) genes may be turned on following radiation via a mechanism involving hypomethylation of cytosine and (2) radiation-induced hypomethylation results from decreased intranuclear levels of DNA methyltransferase.

3691 (AD-A–211190/4/XAB) **Radiation quality and rat motor performance.** Bogo, V.; Zeman, G.H.; Dooley, M. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1989. 13p. (AFRRI-SR–89-15). Available from NTIS, PC A03/MF A01.

Pub. in Radiation Research, Vol. 118, 341-352(1989).

The effects of bremsstrahlung, electron, gamma, and neutron radiations were investigated on the motor performance of male Sprague-Dawley rats. Rats were irradiated at a midline tissue dose rate of 20 Gy/min + or -1 with one of the following:18.6-MeV electrons (N = 40) or 18.1-MVp bremsstrahlung (N = 57) from, a linear accelerator, 60 Co 1.25-MeV gamma-ray photons (N = 48), or reactor neutrons at 1.67-MeV tissue-kerma weighted-mean energy (N = 43). Radiation effects were determined by establishing median effective doses (ED50) for rats trained on an accelerod, a shock-avoidance motor performance test. ED50's were based on 10-min postexposure performance. The ED50's were 61 Gy for electrons, 81 Gy for bremsstrahlung, 89 Gy for gamma-ray photons, and 98 Gy for neutrons. In terms of relative biological effectiveness to produce early performance decrement (10 min from the start of irradiation), significant differences existed between the electrons and the other three fields and between the bremsstrahlung and neutron fields. These differences could not be explained by macroscopic dose distribution patterns in the irradiated animals. The data imply that different radiation qualities are not equally effective at disrupting performance, with high-energy electrons being the most effective and neutrons the least.

3692 (AD-A–211220/9/XAB) **Enhanced acoustic startle responding in rats with radiation-induced hippocampal granule cell hypoplasia.** Mickley, G.A.; Ferguson, J.L. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1989. 8p. (AFRRI-SR–89-20). Available from NTIS, PC A02/MF A01.

Pub. in Experimental Brain Research, Vol. 75, 28-34(1989).

Irradiation of the neonatal rat hippocampus reduces the proliferation of granule cells in the dentate gyrus and results in locomotor hyperactivity, behavioral preservation, and deficits on some learned tasks. In order to address the role of changes in stimulus salience and behavioral inhibition in animals with this type of brain damage, irradiated and normal rats were compared in their startle reactions to an acoustic stimulus. Irradiated rats startled with a consistently higher amplitude than control and were more likely to exhibit startle responses. These animals with hippocampal damage also failed to habituate to the startle stimulus and, under certain circumstances, showed potentiated startle responses after many tone presentations.

3693 (CONF-8909236–2) **Applied exposure modeling for residual radioactivity and release criteria.** Lee, D.W. Oak Ridge National Lab., TN (USA). [1989]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. From JAERI/EPA workshop on residual radiation and recycle criteria; St. Michaels, MD (USA); 27-28 Sep 1989. Order Number DE90002429. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The protection of public health and the environment from the release of materials with residual radioactivity for recycle or disposal as wastes without radioactive contents of concern presents a formidable challenge. Existing regulatory criteria are based on technical judgment concerning detectability and simple modeling. Recently, exposure modeling methodologies have been developed to provide a more consistent level of health protection. Release criteria derived from the application of exposure modeling methodologies share the same basic elements of analysis but are developed to serve a variety of purposes. Models for the support of regulations for all applications rely on conservative interpretations of generalized conditions while models developed to show compliance incorporate specific conditions not likely to be duplicated at other sites. Research models represent yet another type of modeling which strives to simulate the actual behavior of released material. In spite of these differing purposes, exposure modeling permits the application of sound and reasoned principles of radiation protection to the release of materials with residual levels of radioactivity. Examples of the similarities and differences of these models are presented and an application to the disposal of materials with residual levels of uranium contamination is discussed. 5 refs., 2 tabs.

3694 (DOE/ER/60631–2) **Radiation physics, biophysics, and radiation biology: Progress report, December 1, 1988–November 30, 1989.** Hall, E.J.; Zaider, M.; Delegianis, M.J. (ed.). Columbia Univ., New York, NY (USA). Coll. of Physicians and Surgeons. Jul 1989. 99p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60631. Order Number DE90001465. Available from NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

An important event of the year was the designation of our Laboratory as a Center for Radiological Research by the Dean of the Faculty of Medicine and Vice-President for Health Sciences. Center status acknowledges the size and importance of the research efforts in this area, and allows a greater measure of independence in administrative matters. While the name has changed from a Laboratory to a Center within the Medical School, the mission and charge remain the same. The efforts of the Center are a multidisciplinary mix of physics, chemistry, and biology, mostly at a basic level, with the admixture of a small proportion of pragmatic or applied research in support of radiation protection or radiation therapy. About a quarter of our funding, mostly individual research awards, could be regarded as in direct support of radiotherapy, with the remainder (an NCI program project grant and DOE grants) being in support of research addressing more basic issues. An important effort currently underway concerns ab-initio calculations of the dielectric response function of condensed water. This investigation has received the coveted designation, "Grand Challenge Project," awarded by DOE to research work which represents "distinct advance on a major scientific or engineering problem that is broadly recognized as important within the mission of the Department."

3695 (DOE/ER/60631–T4) **The Radiological Research Accelerator Facility: Progress report, December 1, 1988–November 30, 1989.** Hall, E.J. Columbia Univ., New York, NY (USA). Coll. of Physicians and Surgeons. Jul 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60631. Order Number DE90001464. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Radiological Research Accelerator Facility (RARAF) is based on a 4-MV Van de Graaff accelerator, which is used to generate a variety of well characterized radiation chemistry. It is part of the Center for Radiological Research (CRR) – formerly the Radiological Research Laboratory (RRL) – of Columbia University, and its operation is supported as National Facility by the US Department of Energy (DOE). As such, RARAF is available to all potential users on an equal basis, and scientists outside the CRR are encouraged to submit proposals for experiments at RARAF. The operation of the Van de Graaff is supported by the DOE, but the research projects themselves must be supported separately. Data obtained from experiments using RARAF have been of pragmatic value to radiation protection and neutron therapy. At a more fundamental level, the research protection and neutron therapy. At a more fundamental level, the research at RARAF has provided insight into the biological action of radiation and especially its relation to energy distribution in the cell. High-LET radiations are an agent of special importance because measurable cellular effects can be caused by single particles, eliminating some of the complexities of multievent action and more clearly disclosing basic features. This applies particularly to radiation carcinogenesis.

3696 (INIS-BR–1740) **Effects of gamma radiation on Crotalus durissus terrificus venom.** Murata, Y. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). 1988. 68p. (In Portuguese). Order Number DE90608198. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

A poll of crotomine positive Crotalus durissus terrificus venom was dissolved in 0.15 M NaCl and the supernatant irradiated using ^{60}CO. Doses of 100,250,750,1000,1500 and 2000 Cy were used at a dose rate of 1.190Gy/h. The presence of free SH, casein hydrolytic degradation, SDS-PAGE and molecular exclusion chromatography analysis together with LD_{50} determination in mice were studied. The antigenic properties of samples were investigated by immunodiffision and immunoprecipitation. (M.A.C.).

3697 (INIS-BR–1741) **Nursering assistance to the radiological accident patients in Goias-Brazil.** Graciotti, M.E. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Div. de Assistencia Medico-Social. [1989]. 61p. (In Portuguese). Order Number DE90608313. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

A report of a personal experience, during two months of nursing care to the radiological accident victims, due to the disruption of a caesium-137 source, is presented. The biological radiation effects, the radiation hazards due to the doses received and the Kind of exposure, are studied. (M.A.C.).

3698 (INIS-BR–1759) **Acute radiation syndrome in the ^{137}Cs Brazilian accident, 1987.** Valverde, N.J.; Cordeiro, J.M.; Oliveira, A.R.; Brandao Mello, C.E. Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil). [1989]. 21p. Order Number DE90608314. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Eight patients with the most severe degreed of bone marrow impairment are studied. Case descriptions are limited to manifestations and complications related to the 'Acute Radiation Syndrome' (ARS). Medical facilities, exams and therapeutic management are discussed. (MAC).

3699 (INIS-mf–12012) **Free-radical- and radiation-induced damage to DNA.** Schriftenreihe des Max-Planck-Instituts fuer Strahlenchemie. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. 99p. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

This issue contains 39 abstracts about DNA damage by free radicals and radiation. Methods: ESR, ENDOR, FSE, pulse radiolysis, gamma radiation, microcalorimetry. (AJ).

3700 (INIS-mf–12012, pp. 1-3) **Transition metal complexes as sensitizers or protectors against $O_2\cdot^-$ toxicity.** Czapski, G.

(Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry); Goldstein, S. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. COMPLEXES/radioprotective substances; OXYGEN; TOXICITY; COMPLEXES; TRANSITION ELEMENTS; COPPER IONS; DNA; SULFUR IONS; RESPONSE MODIFYING FACTORS; HYDROXYL RADICALS; PEROXY RADICALS

3701 (INIS-mf–12012, pp. 4-6) **Oxygen enhancement of free radical damage to DNA. A comparison of radiation-induced degradation with copper-catalyzed degradation by H_2O_2.** Pruetz, W.A. (Freiburg Univ. (Germany, F.R.). Inst. fuer Biophysik und Strahlenbiologie). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/oxygen enhancement ratio; DNA/gamma radiation; DNA; COMPARATIVE EVALUATIONS; COPPER IONS; OXYGEN; RESPONSE MODIFYING FACTORS; AQUEOUS SOLUTIONS; ELECTRON TRANSFER; HYDROGEN PEROXIDE; RADIOLYSIS; HYDROXYL RADICALS

3702 (INIS-mf–12012, pp. 7-8) **Free radicals formed by electron gain in oligomers of DNA.** Bernhard, W.A. (Rochester Univ., NY (USA). Dept. of Biophysics). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. Grant PHS-R01-CA32546. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. OLIGONUCLEOTIDES/radicals; DNA; OLIGONUCLEOTIDES; RADICALS; ELECTRON SPIN RESONANCE; SPECTRA; DNA ADDUCTS; STRAND BREAKS; X RADIATION; ELECTRON TRANSFER

3703 (INIS-mf–12012, pp. 9-10) **Theoretical studies of molecular mechanisms of DNA damage induced by hydroxyl radicals.** Osman, R. (Mount Sinai School of Medicine, New York, NY (USA). Dept. of Physiology and Biophysics); Clark, W.J.; Mazurek, A.P.; Weinstein, H. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. Grant DE-FG02-88ET60675. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. HYDROXYL RADICALS/configuration interaction; THEORETICAL DATA; DNA; FUNCTIONAL MODELS; DAMAGE; ULTRASTRUCTURAL CHANGES; PHASE TRANSFORMATIONS; STRAND BREAKS

3704 (INIS-mf–12012, pp. 11-12) **Oxidative DNA sugar damage by targeted antibiotic free radicals.** Goldberg, I.H. (Harvard Medical School, Boston, MA (USA). Dept. of Biological Chemistry and Molecular Pharmacology). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. RADICALS/dna; RADICALS/damage; RADICALS; DNA; DAMAGE; ANTIBIOTICS; DNA ADDUCTS; ELECTROSTATICS; CONFIGURATION INTERACTION; STRAND BREAKS

3705 (INIS-mf–12012, pp. 13-14) **Pulse radiolysis of DNA - effects of environment.** O'Neill, P. (Medical Research Council, Chilton (UK). Radiobiology Unit). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/radiolysis; DNA; RADIOLYSIS; MUTAGENESIS; LETHAL IRRADIATION; BIOLOGICAL MODELS; ENVIRONMENTAL EFFECTS; ELECTRON SPIN RESONANCE; ELECTRIC CONDUCTIVITY; LUMINESCENCE; PULSES; CONFORMATIONAL CHANGES; RADIOSENSITIVITY; RADIOSENSITIZERS; HYDRATION

3706 (INIS-mf–12012, pp. 15-16) **Radiation induced clustered damage in DNA.** Hagen, U. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenbiologie); Bertram, H.; Geigl, E.M.; Kohfeldt, E.; Wendel, S. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/local radiation effects; DNA; REVIEWS; IN VITRO; BACTERIOPHAGES; DAMAGE; STRAND BREAKS; GAMMA RADIATION; GENE RECOMBINATION; YEASTS; MUTAGENESIS; BIOLOGICAL REPAIR; ANIMAL CELLS; BIOLOGICAL MODELS; ELECTRON TRANSFER

3707 (INIS-mf–12012, pp. 19-21) **A physicochemical aspects of radioprotection and sensitized cancer radiotherapy.** Kagiya, V.T. (Kyoto Univ. (Japan). Dept. of Hydrocarbon Chemistry); Nishimoto, Sei-ichi. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. NEOPLASMS/radiotherapy; RADIOSENSITIZERS; NEOPLASMS; RADIOTHERAPY; PHYSICAL CHEMISTRY; RADIOPROTECTIVE SUBSTANCES; TUMOR CELLS; RADIOSENSITIVITY; LETHAL IRRADIATION; OVARIES; IN VITRO; ANOXIA; CORRELATION FUNCTIONS; CELL KILLING; RADIOLYSIS; RADICALS

3708 (INIS-mf–12012, pp. 22-24) **ESR and ENDOR studies of X-irradiated single crystals of guanine derivatives.** Close, D.M. (East Tennessee State Univ., Johnson City (USA)); Nelson, W.H.; Sagstuen, E.; Hole, E.O. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. Grant NIH CA-36810;NATO RG 86/0077. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. GUANINE/electron spin resonance; GUANINE; DAMAGE; RADICALS; DNA; X RADIATION; RADIATION CHEMISTRY; ELECTRON LOSS; MONOCRYSTALS

3709 (INIS-mf–12012, pp. 25) **Free radicals from solid oriented DNA-fibers: Facts and fancy.** Huettermann, J. (Saarland Univ., Homburg/Saar (Germany, F.R.). Fachrichtung Biophysik und Physikalische Grundlagen der Medizin). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/electron spin resonance; DNA; ORIENTATION; FIBERS; RADICALS; REVIEWS; RADIOSENSITIZERS; FUNCTIONAL MODELS

3710 (INIS-mf–12012, pp. 26-27) **The competition between oxidants (radiosensitizers) and reductants (radioprotectors) in modifying free-radical damage to DNA.** Wardman, P. (Mount Vernon Hospital, Northwood (UK). Gray Lab.). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/radiosensitivity; RADIOSENSITIZERS; RADIOPROTECTIVE SUBSTANCES; RADICALS; DNA; RADIOSENSITIVITY; DAMAGE; ELECTRON TRANSFER; BIOLOGICAL REPAIR

3711 (INIS-mf–12012, pp. 30-31) **DNA damage in frozen aqueous solution: Sequence dependence and end groups.** Cullis, P.M. (Leicester Univ. (UK). Dept. of Chemistry); Jones, G.D.D.; Sweeney, M.C.; Symons, M.C.R.; Wren, B.W. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/damage; DNA; DAMAGE; AQUEOUS SOLUTIONS; MUTAGENESIS; CARCINOGENESIS; HYDROXYL RADICALS; IN VIVO; GAMMA RADIATION; RADICALS; STRAND BREAKS

3712 (INIS-mf–12012, pp. 32-35) **Free radical formation in single crystals of 2-deoxyguanosine 5'-monophosphate, and guanine hydrobromide monohydrate after X-irradiation at 10 and 65 K: An ESR, ENDOR and FSE study.** Hole, E.O. (Oslo Univ. (Norway)); Sagstuen, E.; Nelson, W.H.; Close, D.M. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. Contract DE-A505-83ER60159;Grant NIH CA-36810;NATO RG 88/0077. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/electron spin resonance; X RADIATION; RADICALS; MONOCRYSTALS; DNA; LOW DOSE IRRADIATION; ENDOR

3713 (INIS-mf–12012, pp. 36-37) **Matrix-isolation of free radicals from purines and derivatives in aqueous low temperature glasses.** Sieber, K. (Saarland Univ., Homburg/Saar (Germany, F.R.). Fachrichtung Biophysik und Physikalische Grundlagen der Medizin); Ohlmann, J.; Huettermann, J. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. RADICALS/matrix isolation; PURINES/electron spin resonance; RADICALS; PURINES; RADIATION CHEMISTRY; GLASS; AQUEOUS SOLUTIONS

3714 (INIS-mf–12012, pp. 38-40) **ESR investigations of the reactions of radiation-produced thiyl and peroxyl radicals: Formation of sulfoxyl radicals.** Sevilla, M.D. (Oakland Univ., Rochester, MI (USA). Dept. of Chemistry); Becker, D.; Yan, M. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. RADIOPROTECTIVE SUBSTANCES; ELECTRON SPIN RESONANCE; RADICALS; BIOLOGICAL REPAIR; RADIOLYSIS

3715 (INIS-mf–12012, pp. 41-43) **The effect of oxygen and thiols on the radiation damage of DNA.** Schulte-Frohlinde, D. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/response modifying factors; DNA/gamma radiation; OXYGEN; DNA; DAMAGE; THIOLS; BACTERIOPHAGES; ESCHERICHIA COLI; SURVIVAL CURVES; REVIEWS; BIOLOGICAL REPAIR; BACTERIA; ANIMAL CELLS

3716 (INIS-mf–12012, pp. 44-45) **Radiation chemistry of adenine derivatives following direct ionization in solids: ESR and ENDOR investigations.** Nelson, W.H. (Georgia State Univ., Atlanta (USA)); Close, D.M.; Sagstuen, E.; Hole, E.O. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. Contract DE-AS05-83ER60159;Grant NIH CA-36810;NATO RG 86/0077. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. ADENINES/electron spin resonance; RADIATION CHEMISTRY; ADENINES; IONIZATION; RADICALS; ENDOR

3717 (INIS-mf–12012, pp. 46-48) **Free radicals formation in nucleosides and nucleotides of guanine: ESR and ENDOR of guanosine 5'-monophosphate and guanosine: Dimethylformamide X-irradiated at 10 K.** Sagstuen, E. (Oslo Univ. (Norway)); Hole, E.O.; Nelson, W.H.; Close, D.M. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. GUANINE/radicals; NUCLEOSIDES; NUCLEOTIDES; GUANINE; RADICALS; ELECTRON SPIN RESONANCE; X RADIATION; ENDOR

3718 (INIS-mf–12012, pp. 49-50) **Free radical generation by ultrasound in aqueous solutions of DNA constituents.** Kondo, T. (National Institutes of Health, Bethesda, MD (USA). Radiation Oncology Branch); Krishna, C.M.; Riesz, P. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. ULTRASONIC WAVES/radiation chemistry; RADICALS; AQUEOUS SOLUTIONS; DNA; REVIEWS; HYDROXYL RADICALS; ELECTRON SPIN RESONANCE

3719 (INIS-mf–12012, pp. 51-52) **The $SO^{-}{}_{4}$-induced oxidation of 1,3,6-trimethyluracil and 1,3-dimethylthymine by potassium peroxodisulphate and oxygen in aqueous solution: An interesting contrast.** Sonntag, C. von (Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.)); Rashid, R.; Schuchmann, H.P.; Mark, F. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. SULFATES/oxidation; SULFATES; OXIDATION; URACILS; THYMINE; METHYL RADICALS;

RADIOLYSIS; AQUEOUS SOLUTIONS; IONIZING RADIATIONS; DAMAGE; DNA

3720 (INIS-mf–12012, pp. 53-54) **Pulse radiolysis studies on one-electron oxidation of purines.** Steenken, S. (Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.)). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. PURINES/radiolysis; ELECTRON DENSITY; PULSE TECHNIQUES; ELECTRON TRANSFER; OXIDATION; PURINES; RADIOLYSIS; RADICALS

3721 (INIS-mf–12012, pp. 55-56) **Free radical and radiation-induced DNA damage to oligonucleotides.** Teoule, R. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale); Duplaa, A.M. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/damage; DNA/gamma radiation; RADICALS; OLIGONUCLEOTIDES; DNA; DAMAGE; PHOSPHORUS 32; LABELLING; RADIOSENSITIVITY; NUCLEOSIDES; THEORETICAL DATA; AUTORADIOGRAPHY; ELECTROPHORESIS

3722 (INIS-mf–12012, pp. 57-58) **Radical-induced DNA damage and specific implications in evaluating genetic changes.** Chatterjee, A. (Lawrence Berkeley Lab., CA (USA). Biology and Medicine Div.). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/damage; DNA; DAMAGE; HYDROXYL RADICALS; GENETIC RADIATION EFFECTS; IN VITRO; STRAND BREAKS; EXPERIMENTAL DATA; X-RAY DIFFRACTION; EMBRYONIC CELLS; RADIATION INDUCED MUTANTS; HERPES SIMPLEX; VIRUSES; BIOLOGICAL REPAIR; THEORETICAL DATA; COMPARATIVE EVALUATIONS; MONTE CARLO METHOD

3723 (INIS-mf–12012, pp. 59-62) **Studies of radiation damage using DNA oligomers.** Box, H.C. (Roswell Park Memorial Inst., Buffalo, NY (USA). Dept. of Biophysics); Paul, C.R.; Przybyszewski, J. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. Grant NCI CA46838;NCI CA44808. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/damage; DNA; DAMAGE; NUCLEOTIDES; IONIZING RADIATIONS; NUCLEAR MAGNETIC RESONANCE; NMR SPECTRA; X RADIATION; LIQUID COLUMN CHROMATOGRAPHY; PROTONS

3724 (INIS-mf–12012, pp. 63-64) **Background levels of DNA damage.** Bergtold, D.S. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research); Simic, M.G. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/damage; DNA; DAMAGE; BIOLOGICAL REPAIR; METABOLISM; RADICALS; ALKYLATING AGENTS; GENETIC EFFECTS; URINE; EXCRETION

3725 (INIS-mf–12012, pp. 65-67) **Secondary reaction in irradiated nucleotides: Possible significance for chemical 'repair' mechanisms.** Raleigh, J.A. (North Carolina Memorial Hospital, Chapel Hill, NC (USA). Dept. of Radiation Oncology). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/radiolysis; RADIOSENSITIZERS; NUCLEOTIDES; IONIZING RADIATIONS; DNA; RADIOLYSIS; FUNCTIONAL MODELS; RADICALS; RADIATION CHEMISTRY; BIOCHEMISTRY

3726 (INIS-mf–12012, pp. 68-69) **Spin trapping of sugar radicals in solid and aqueous phases.** Kuwabara, Mikinori (Hokkaido Univ., Sapporo (Japan). Dept. of Radiation Biology). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. RADICALS/endor; RADICALS; ENDOR; DNA; NUCLEOSIDES; NUCLEOTIDES; ADDUCTS; GAMMA RADIATION; ELECTRON SPIN RESONANCE; DAMAGE; AQUEOUS SOLUTIONS; ANAEROBIC CONDITIONS

3727 (INIS-mf–12012, pp. 70-72) **Radiation induced release of undamaged uracil from polyuridylic acid and the formation of phosphomonoester end groups in irradiated polynucleotides.** Deeble, D.J. (North Wales Inst., Connah's Quay (UK). Kelsterton Coll.); Sonntag, C. von. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. URACILS/radiation chemistry; NUCLEOTIDES; RADIOLYSIS; BIOLOGICAL RADIATION EFFECTS; URACILS; RIBOSE; STRAND BREAKS; POLYMERIZATION

3728 (INIS-mf–12012, pp. 73) **Rate and yield of OH-induced strand break formation of polynucleotides and DNA.** Bothe, E. (Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.)); Adinarayana, M.; Schulte-Frohlinde, D. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. STRAND BREAKS; NUCLEOTIDES; POLYMERIZATION; DNA; HYDROXYL RADICALS; LIGHT SCATTERING; LASERS; BIOLOGICAL MODELS; RADIOLYSIS; QUANTITY RATIO

3729 (INIS-mf–12012, pp. 82) **Protein-DNA-crosslinks induced by primary and secondary radicals.** Schuessler, H. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Inst. fuer Radiologie); Jung, E. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. CROSS-LINKING; DNA; CROSS-LINKING; RADICALS; RADIOLYSIS; STRAND BREAKS; ANAEROBIC CONDITIONS; PROTEINS

3730 (INIS-mf–12012, pp. 78-79) **ESR studies on the mechanism of ·OH-induced strand breakage of Poly(U).** Hildenbrand, K. (Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.)); Schulte-Frohlinde, D. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. STRAND BREAKS/electron spin resonance; HYDROXYL RADICALS; URACILS; POLYMERIZATION

3731 (INIS-mf–12012, pp. 77) **The thermodynamic basis of the genetic code.** Klump, H.H. (Cape Town Univ. (South Africa). Dept. of Biochemistry). Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/thermodynamics; DNA; THERMODYNAMICS; CALORIMETRY; EXPERIMENTAL DATA; GENETICS

3732 (INIS-mf–12012, pp. 80-81) **The reactions of peptide peroxyl radicals in aqueous solution.** Mieden, O.J. (Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.)); Sonntag, C. von. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. HYDROXYL RADICALS/radiation chemistry; AQUEOUS SOLUTIONS; TOXICITY; ESCHERICHIA COLI; DNA; DAMAGE; GAMMA RADIATION; HYDROLYSIS

3733 (INIS-mf–12012, pp. 83) **Interaction of ruthenium complexes with nucleic acids. DNA damage via sensitized radical production.** Tossi, A.B. (Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.)); Goerner, H.; Aboul-Enein, A.; Schulte-Frohlinde, D. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. NUCLEIC ACIDS/configuration interaction; DNA; DAMAGE; RUTHENIUM; COMPLEXES; RADICALS; RADIOSENSITIZERS

3734 (INIS-mf–12012, pp. 84) **Free radicals in irradiated oriented DNA fibers: Results from B-form DNA and from deuterated DNA samples.** Zell, I. (Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.). Inst. fuer Biophysik); Huettermann, J.; Graeslund, A.; Rupprecht, A.; Koehnlein, W. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/electron spin resonance; RADICALS; DNA; ALGAE; KINETICS

3735 (INIS-mf–12012, pp. 74-76) **Enzymatic repair of oxidative DNA damage.** Teebor, G.W. (New York Univ. Medical Center, NY (USA). Dept. of Pathology); Boorstein, R.J.; Cannon, S.V. Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.). 1988. (CONF-8809414–: International symposium on free-radical and radiation-induced damage to DNA, Muelheim an der Ruhr (Germany, F.R.), 25-30 Sep 1988). In *Free-radical- and radiation-induced damage to DNA.* Order Number DE90722496. Available from NTIS (US Sales Only), PC A05/MF A01.

Published in summary form only. DNA/biological repair; DNA; DAMAGE; OXIDATION; IONIZING RADIATIONS; ANIMAL CELLS

3736 (INIS-SU–114, pp. 40-41) **Local radiation injuries.** Bardychev, M.S. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; RADIOTHERAPY/radiation injuries; RADIOTHERAPY/side effects; DELAYED RADIATION EFFECTS; EARLY RADIATION EFFECTS; INTEGRAL DOSES; IONIZING RADIATIONS; NEOPLASMS; RADIOTHERAPY; PATHOLOGICAL CHANGES; PATIENTS

3737 (INIS-SU–114, pp. 42-43) **Conservative and surgical treatment of rectovaginal fistules induced by irradiation.** Berdov, B.A.; Bardychev, M.S.; Abramyan, S.G. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; RADIOTHERAPY/fistulae; RADIOTHERAPY/side effects; CARCINOMAS; RADIOTHERAPY; PATIENTS; RADIATION INJURIES; FISTULAE; SURGERY; UROGENITAL SYSTEM DISEASES

3738 (INIS-SU–114, pp. 47-48) **Mathematical model for evaluation of delayed injuries of rectum in radiotherapy.** Klepper, L.Ya.; Makarova, G.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. RADIATION INJURIES/mathematical models; RADIOTHERAPY/neoplasms; RADIOTHERAPY/side effects; DELAYED RADIATION EFFECTS; PATIENTS; RADIATION DOSES; RADIOTHERAPY; NEOPLASMS; RECTUM

3739 (INIS-SU–114, pp. 55-56) **Chemoluminescence and antioxidative blood activity in patients with rectum cancer in radiotherapy.** Ovchinnikov, V.A.; Abakumov, G.Z.; Berezhnov, I.P. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380–: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. NEOPLASMS/radiotherapy; RADIOTHERAPY/blood chemistry; RADIOTHERAPY/side effects; CHEMILUMINESCENCE; FRACTIONATED IRRADIATION; GAMMA RADIATION; LIPIDS; NEOPLASMS; RADIOTHERAPY; PATIENTS; RECTUM

3740 (INIS-SU–114, pp. 51-53) **Radiation injuries following repeated irradiation by mean dose fractionating of multiple bone metastases of breast cancer.** Monazl', G.D. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian).

(CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. RADIATION INJURIES/radiotherapy; RADIATION INJURIES/side effects; RADIOTHERAPY/metastases; FRACTIONATED IRRADIATION; GAMMA RADIATION; INTEGRAL DOSES; MAMMARY GLANDS; NEOPLASMS; PATIENTS; PROTON BEAMS; RADIOTHERAPY; METASTASES; SKELETON

3741 (INIS-SU--114, pp. 58-60) **Dependence of local radiation complications on methods of intracavitary gamma-therapy in concomitant radiotherapy of stage 1 cervix uteri carcinoma.** Savkova, N.V. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. 1 tab. AFTERLOADING/side effects; CARCINOMAS/afterloading; RADIATION INJURIES/irradiation procedures; AFTERLOADING; CARCINOMAS; GAMMA RADIATION; PATIENTS; UROGENITAL SYSTEM DISEASES

3742 (INIS-SU--114, pp. 54-55) **Relationship of free CoA and long-chain Acyl-CoA in liver of animals after whole-body gamma irradiation.** Ovchinnikov, V.A. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CONCANAVALIN/metabolism; COBALT 60; CONCANAVALIN; METABOLISM; GAMMA RADIATION; LIVER; RATS; TIME DEPENDENCE; WHOLE-BODY IRRADIATION

3743 (INIS-SU--114, pp. 38-39) **Local radiation injuries after radiotherapy on radical program in patients with locally disseminated lung carcinoma subjected to exploratory thorocotomy.** Artemova, N.A.; Shapiro, A.M. Minskij Meditsinskij Inst., Minsk (Byelorussian SSR). 1988. (In Russian). (CONF-8809380--: 4. conference of roentgenologists and radiologists of Byelorussian SSR, Grodno (USSR), 8 Sep 1988). In *Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports.* Order Number DE90705937. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

AT-11764.

Short note. CARCINOMAS/radiotherapy; RADIOTHERAPY/radiation injuries; CARCINOMAS; RADIOTHERAPY; FRACTIONATED IRRADIATION; LUNGS; PATIENTS; RESPIRATORY SYSTEM DISEASES; SIDE EFFECTS; SURGERY

3744 (LA--11652-MS) **Quality-assurance plan for the Basic Environmental Compliance and Monitoring Program (BECAMP).** Essington, E.H. Los Alamos National Lab., NM (USA). Sep 1989. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90002278. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This quality-assurance plan (QAP) provides guidance for the preparation of detailed procedures to document the steps and considerations for executing a range of activities from environmental sampling and observations, to data archiving, reporting, and dose assessment calculations. The QAP is administered and updated by the quality-assurance principal investigator as a management tool to track the progress of the tasks of the Basic Environmental Compliance and Monitoring Program. Proper execution of the quality-assurance program assures that methodology and data are defensible and usable for such activities as cleanup and treatment and for dose assessment calculations of radionuclides at the Nevada Test Site. 1 fig.

3745 (LBL--27918) **DNA damage in mammalian cells following heavy-ion irradiation.** Rosander, K.; Frankel, K.A.; Cerda, H.; Phillips, M.H.; Lo, E.H.; Fabrikant, I.; Fabrikant, J.I.; Levy, R.P. Lawrence Berkeley Lab., CA (USA). Sep 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8905227--2: International conference on radiosurgery a neurosurgical approach to intracranial lesions, Charlottesville, VA (USA), 1-5 May 1989). Order Number DE90003116. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In our laboratory we have been investigating DNA damage and repair in the endothelial and oligodendroglial cells of the mouse brain after irradiation using two different types of heavy ions, helium and neon. The method used, the unwinding technique with subsequent staining of the DNA with acridine orange, has been proven to be useful for nondividing cells and analysis using a microscope photometric technique. Our primary goal has been to obtain a measure of RBE, in the dose range used in clinical treatment of various brain disorders using heavy charged particle radiosurgery. 12 refs., 5 figs.

3746 (ORNL--6579) **Radionuclide deposition and exposure in the Federal Republic of Germany after the Chernobyl accident.** Winkelmann, I.; Haubelt, R.; Neumann, P.; Fields, D.E. Oak Ridge National Lab., TN (USA). Nov 1989. 30p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003104. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Analyses of air, water, and foodstuff samples, together with in situ gamma spectrometric measurements in the Federal Republic of Germany, have documented the deposition and exposure consequences of the Chernobyl accident. In some cases, exposure values are significantly higher than background levels. Data compiled for the period from the initial identification of excess atmospheric radioactivity to the present, represent a unique resource for testing and validating models of environmental transport and human exposure. These data will serve as the bases for future studies of organism response, both somatic and genetic, to nuclear radiation. They will also prove useful in suggesting modifications to environmental sampling and monitoring systems. 14 refs., 13 figs., 4 tabs.

3747 (ORNL/FTR--3415) **[Environmental transport and health effects of radioactive materials]: Foreign trip report, September 16, 1989--October 7, 1989.** Eckerman, K.F. Oak Ridge National Lab., TN (USA). 16 Oct 1989. 64p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002511. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The objectives of the traveler were to participate in the first meeting of Working Group 7 of the US--USSR. Joint Coordinating Committee on Civilian Nuclear Reactor Safety (JCCCNRS) in an effort to outline future collaborative research programs. The traveler participated in the discussion on environmental transport held in Moscow and those on health effects held in Kiev. The purpose of this research is to improve the capability of both countries to rapidly forecast the potential environmental and health consequences of large nuclear accidents. Soviet scientists are eager to participate in collaborative research with the US. Following the meetings in the USSR, the traveler, as a member of Committee 2, attended the meeting of the ICRP in Oxford, UK, during the first week of October 1989.

3748 (PNL-SA--16690) **The microdosimetry of radon decay products in the respiratory tract.** Fisher, D.R.; Hui, T.E.; Poston, J.W. Pacific Northwest Lab., Richland, WA (USA). 1989. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-890517--5: 10. symposium on microdosimetry, Rome (Italy), 21-26 May 1989). Order Number DE90002893. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this study was to develop methods for calculating the probability density in specific energy for cell nuclei of the respiratory tract epithelium irradiated by inhaled radon and daughter products. Microdosimetry also provides the probability that cell nuclei may be hit by alpha particles, the probability that cell nuclei are completely missed, and the mean (absorbed) dose to cell nuclei.

Such information is useful for interpreting the significance of an inhalation exposure to radon and daughters. 23 refs., 5 figs., 3 tabs.

3749 (PNL-SA–16859-HEDR) **The Hanford Environmental Dose Reconstruction Project: Overview.** Haerer, H.A.; Freshley, M.D.; Gilbert, R.O.; Morgan, L.G.; Napier, B.A.; Rhoads, R.E.; Woodruff, R.K. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891072–3: 27. Hanford symposium on health and the environment: multilevel research–molecules to man, Richland, WA (USA), 18-20 Oct 1989). Order Number DE90001899. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In a multi year effort that began in 1988, researchers at the Pacific Northwest Laboratory are estimating radiation doses that people could have received since 1944 from nuclear operations at the US Department of Energy's Hanford Site. Known as the Hanford Environmental Dose Reconstruction Project, the work has required the development of new methods and tools for dealing with unique technical and communication challenges. Scientists are doing probabilistic dose assessment – rather than the more typical deterministic approach – to generate dose distributions rather than single-point estimates. Uncertainties in input parameters are reflected in the dose results. Sensitivity analyses are used to optimize project resources in defining the project's scope. An independent technical steering panel directs and approves the work in a public forum. 3 figs.

3750 (PNL-SA–16874-HEDR) **Hanford environmental dose reconstruction project: Technical approach.** Napier, B.A.; Haerer, H.A.; Rhoads, R.E.; Gilbert, R.O.; Woodruff, R.K.; Freshley, M.D. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891072–4: 27. Hanford symposium on health and the environment: multilevel research–molecules to man, Richland, WA (USA), 18-20 Oct 1989). Order Number DE90002723. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Historical measurements and current assessment techniques are being combined in the Hanford Environmental Dose Reconstruction (HEDR) Project to estimate radiation doses that people could have received from radionuclide releases from the Hanford Site since 1944. Doses are being estimated on the basis of geographic location, age, lifestyle, ethnic group, and dietary habits. Demographic groups under study include the general population, Native American tribes, Army personnel, construction workers, and migrant workers. The model structure enables the input of calculated or measured data at each step. The ability to incorporate uncertainties – caused by natural variability and by gaps in historical data – is woven into the model structure for every key parameter and reflected in the dose results. Final results will be ranges of potential doses with distributions of expected values. The approach is the largest application of stochastic analysis attempted from the very inception of a dose reconstruction project. 3 figs.

3751 (PNL-SA–17026) **Environmental monitoring for radionuclides, chemicals, fish and wildlife at a US energy research facility: A case story.** Gray, R.H. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8909243–2: Global natural resource monitoring and assessments: preparing for the 21st century, Venice (Italy), 24-30 Sep 1989). Order Number DE90002665. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Environmental monitoring has been an ongoing activity on the US Department of Energy's 560 m^2 Hanford Site in southeastern Washington, USA, for 45 years. Objectives are to detect and assess potential impacts of site operations on air, surface and ground water, foodstuffs, fish, wildlife, soils and vegetation. Data from monitoring efforts are used to calculate the overall radiological dose to humans working onsite or residing in nearby communities. In 1988, measured Hanford Site perimeter concentrations of airborne radionuclides were below applicable guidelines. Tritium and nitrate continued to be the most widespread constituents in onsite ground water. Concentrations of radionuclides and nonradiological water quality in the Columbia River were in compliance with applicable standards. Foodstuffs irrigated with river water downstream of the Site showed low levels of radionuclides that were similar to concentrations found in foodstuffs from control areas. Low levels of ^{90}Sr and ^{137}Cs in some onsite wildlife samples and concentrations of radionuclides in soils and vegetation from onsite and offsite locations were typical of those attributable to worldwide fallout. The calculated dose potentially received by a maximally exposed individual (i.e., based on hypothetical assumptions for all routes of exposure) in 1988 (0.08 mrem/yr) was similar to that calculated for 1985 through 1987. 31 refs., 3 figs.

3752 (UCID–21824) **Bounding dispersion analysis for rare-earth elements as it pertains to the Engineering Demonstration System surrogate testing.** Ernst, K. Lawrence Livermore National Lab., CA (USA). Oct 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-48. Order Number DE90001788. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In order to provide a perspective of the maximum consequences associated with the handling of the rare-earth elements as it pertains to the Engineering Demonstration System (EDS), we have evaluated a hypothetical (nonmechanistic) material dispersion in which no action is taken to mitigate the consequences. The following scenario has been devised to impart a maximum impact to the environment. There is no basis to assume that such a dispersion could ever occur during the conduct of the EDS surrogate tests. The term "lanthanon" as used in this report refers to any members of the lanthanide series (atomic numbers 57 to 71) of rare-earth elements with the exception of lutetium, promethium, and samarium. The included lanthanons have a level of natural radioactivity comparable to, or orders-of-magnitude less than that of typical soil. If there were any risk to the environment, it would result from any chemical toxicity of the lanthanons. 8 refs., 1 fig., 3 tabs.

3753 **The behavior and chemical toxicity of U in the kidney: A reassessment.** Leggett, R.W. (Oak Ridge National Lab., TN (USA)). *Health Physics (USA),* 57(3): 365-383 (Sep 1989).

By the late 1950s, the views had evolved that (1) U does not enter cells but damages the kidneys by binding to the luminal membranes of renal tubular cells, interfering with reabsorption of glucose, sodium, amino acids, protein, water, and other substances, and causing slow cell death by suppression of respiration; and (2) U does not cause significant damage to the kidneys at concentrations below 3 micrograms U g-1 kidney. Although there has not been a major unified effort in the past three decades to update the toxicology of U as a nephrotoxin, there have been numerous isolated studies that may be useful in reevaluating these longstanding views on the behavior and action of U in the kidneys and the renal U concentration at which toxic effects may become evident. This paper is a brief review and synthesis of current information on U nephrotoxicity. Much more experimental research and reevaluation of existing data are needed concerning U nephrotoxicity, particularly for the case of chronic exposure. 164 references.

3754 **Radiobiology of ultrasoft X rays. IV. Flat and round-shaped hamster cells (CHO-10B, HS-23).** Carpenter, S. (Los Alamos National Lab., NM (USA)); Cornforth, M.N.; Harvey, W.F.; Raju, M.R.; Schillaci, M.E.; Wilder, M.E.; Goodhead, D.T. *Radiation Research (USA),* 119(3): 523-533 (Sep 1989).

The results reported earlier in this series indicated that the relative biological effectiveness (RBE) of ultrasoft X rays decreases with decreasing cell thickness, approaching unity for the thinnest cells used, plateau-phase human skin fibroblasts (HSF). The possible dependence of RBE on the configuration of the cell nucleus is investigated further in this paper using two CHO cell lines that attach well and have similar intrinsic radiosensitivities to 60Co gamma rays. One of the lines forms monolayers similar to V79 cells, while the other remains more spherical during growth. We find an increasing RBE with decreasing X-ray energy for both of these cell lines, consistent with our results using V79 cells. Also consistent with our results obtained with 10T1/2 and HSF cells, we find an increasing RBE with increasing cell thickness. The possible dependence of RBE on radiosensitivity and the use of the concept of mean dose for ultrasoft X rays is discussed.

5602 Thermal Effects

Refer also to citation(s) 2278

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 3414, 3416, 3430, 3435, 3445, 3446, 3447, 3450, 3461, 3463, 3468, 3549, 3550, 3612

3755 (AD-A-210344/8/XAB) **Human-health studies of carbon monoxide (CO) under conditions of military weapons systems crewman exposures. Protocol 1: Formation of cohb. Final report, September 1982-March 1985.** Benignus, V.A.; Hazucha, M.; Petrovick, M.L.; McCartney, M.L.; Kizakevich, P.N. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 29 Sep 1988. 128p. Available from NTIS, PC A07/MF A01.

The present experiment was performed as a first step to evaluate the accuracy of prediction of carboxyhemoglobin (COHb) formation due to quasi-steady-state carbon monoxide (CO) exposure by use of the Coburn-Forster-Kane equation (CFKE) and related models. Thirteen healthy young males were exposed to CO in room air for 120 minutes. While they were being exposed to CO, they either rested or performed bicycle exercise at one of two moderate work levels (25 or 40 watts). Also during exposure to CO, blood samples were drawn every five min to assess the COHb level. Many of the variables of the CFKE were measured in individual subjects rather than using published norms.

3756 (AD-A-211221/7/XAB) **Effects of iron particles on behavior and brain function: Initial studies.** Hunt, W.A.; Rabin, B.M.; Joseph, J.A.; Dalton, T.K.; Murray, W.E. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1988. 16p. (AFRRI-SR-89-17). Available from NTIS, PC A03/MF A01.

Pub. in Terrestrial Space Radiation and Its Biological Effects, 537-551(1988).

Successful operations in space depend in part on the performance capabilities of astronauts and little is known about potential consequences of exposure to ionizing radiation on behavior and the brain during manned space flights. This possible threat has not been given much attention, since all manned missions have been located in low equatorial orbit and radiation which have not been considered hazardous. Future missions in space will probably involve polar orbits, long-term space travel beyond the Earth, and extended periods during which astronauts are operating outside their spacecraft. Since exposure to radiation increases under these conditions because of the absence of the Earth's normally protective transpolar magnetosphere, astronauts may be placed at considerable additional risk. An understanding of this risk may be vital to the survival and effective performance of future missions in space. Therefore, it is desirable to understand the medical and operational risks to personnel, including an assessment of possible behavioral and neurobiological deficits.

3757 (AD-A-211270/4/XAB) **Validation and application of pharmacokinetic models for interspecies extrapolations in toxicity risk assessments of volatile organics. Annual report No. 2, 1 July 1988-30 June 1989.** Dallas, C.E.; Bruckner, J.V.; Gallo, J.; Ramanathan, R.; Muralidhara, S. Georgia Univ., Athens, GA (USA). 21 Jul 1989. 129p. Available from NTIS, PC A07/MF A01.

In pursuit of the goal of establishing a scientific basis for the interspecies extrapolation of pharmacokinetic data in health-risk assessments, a series of studies were conducted involving pharmacokinetic determinations in rats to several aliphatic halocarbons (with parallel studies initiated in the dog). Direct measurements of the uptake and elimination of halocarbon in rats were completed during the following inhalation exposures and following oral administration of dichloroethylene (DCE) and perchloroethylene (PCE). An assay for the measurement of halocarbons in the tissues of exposed animals has been successfully developed, and tissue-concentration profiles in the liver, kidney, lung, fat, brain, muscle, and heart were completed for oral and intraarterial administrations of PCE. The utility of the physiologically-based pharmacokinetic model for the accurate computer simulations of the pharmacokinetics of three halocarbons with wide variation in physicochemical properties (TRI, TCE, and PCE) has been demonstrated.

3758 (CONF-890422-1) **A perspective on human exposure to PCDDs and PCDFs emitted form municipal waste combustors.** Hattemer-Frey, H.A.; Travis, C.C. Environmental Protection Agency, Washington, DC (USA). [1989]. 15p. DOE Contract AC05-84OR21400. From International conference on municipal waste combustion; Hollywood, FL, US; April 11, 1989. Order Number DE89008725. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses the following key issues concerning human exposure to polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) emitted from modern municipal waste combustors (MWCs): (1) Are MWCs the major source of PCDD/PCDF input into the environment? (2) Are environmental concentrations around MWCs substantially elevated relative to background levels? and (3) Are MWCs the major source of human exposure to PCDDs and PCDFs? Current scientific evidence indicates that: (1) combustion sources in general (including steel mills, copper melting plants, motor vehicles, hospital incinerators, and MWCs) are major sources of PCDD/PCDF input in the environment; (2) environmental concentrations of PCDDs and PCDFs around operating MWCs are not substantially elevated; and (3) 99% of human exposure to PCDDs and PCDFs is from background environmental contamination, even for individuals living near a modern municipal waste combustor. 43 refs., 4 tabs.

3759 (CONF-8910275-1) **PCBs in humans: What we know and what we don't know.** Erickson, M.D. Argonne National Lab., IL (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Electric Power Research Institute PCB seminar; San Diego, CA (USA); 3-6 Oct 1989. Order Number DE90001912. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

PCBs are found in the adipose tissue of humans through environmental, dietary, and occupational exposure. Measurement of PCB concentrations in human adipose, blood, and other tissues has begun to give a picture of the human body burden. Total aggregate PCB concentrations are of some use, but the fingerprint chromatograms from the individual congeners tell much more about the exposure (e.g., which Aroclor is involved), uptake, and metabolism of PCBs.

3760 (DOE/ER/60015-7) **Interactions of carcinogens with DNA [deoxyribonucleic acid]: Final progress report, July 1, 1987-July 31, 1989.** Broyde, S.; Shapiro, R. New York Univ., NY (USA). Oct 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-81ER60015. Order Number DE90002880. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The principal goal of this research has been the determination of the conformational changes produced in DNA by the covalent binding of a carcinogenic aromatic amine, and the correlation of these changes with the mutations and carcinogenic effects initiated by the same substances. To this end, we have devised new synthetic methods for the preparation of oligonucleotides modified by derivatives af 4-aminobiphenyl and aniline. We have also performed potential energy minimization studies on the above substances and on single and double stranded DNA fragments bearing the above amines as well as acetylaminofluorene, aminofluorene, aminopyrene and the antibiotic mitomycin. Our computations have been carried out on DOE supercomputers using our program, DUPLEX. We have defined a number of novel structures for these modified DNAs, including Hoogsteen, "wedge" (see below) denatured, cross-linked and intercalated forms. Some suggestions have been made about the relation of these forms to mutagenesis. 7 refs.

3761 (DOE/ER/60588-3) **The impact of energy related pollutants on chromosome structure: Progrss report, May 1, 1987-April 30, 1990.** Rill, R.L. Florida State Univ., Tallahassee, FL (USA). Inst. of Molecular Biophysics. 30 Oct 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER60588. Order Number DE90002541. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The sequence preferences of DNA binding by five intercalating chemicals were examined by techniques analogous to chemical DNA sequencing. The intercalators used were 7R, 8S-dihydroxy-9S, 10R-epoxy-7, 8, 9, 10-tetrahydrobenzo[a]pyrene [anti-(+)-BPDE]

and its enantiomer, anti-(−)-BPDE; 8-azido-ethidium, 7-azido-actinomycin D, and bis-(1, 10-phenanthroline)Cu(I). The former four compounds form covalent adducts, some fraction of which are labile and cause DNA chain cleavage upon treatment with hot piperidine. The latter compound causes spontaneous chain cleavage via activated oxygen species generated in the presence of molecular oxygen and a reducing agent. Quantitative mapping data on the DNA cleavages caused by these chemicals were obtained on over 1200 DNA bases in restriction fragments and were statistically analyzed. The sequence preferences of all compounds were best described in terms of base triplets, but bases flanking the preferred triplets also influenced binding in many cases. Although the intercalators differed in degree of sequence selectivity and triplet sequences most preferred, YRY and YGG sequences were generally preferred, especially when the 5'-Y was T, while RRY and oligo-purine/oligo-pyrimidine tracts were generally avoided. Details of individual intercalator preferences and other features of the DNA binding of these compounds are described. 17 refs.

3762 (ETDE-mf–0718061) **Effects of acid and lime on mesofauna of forest soils in the laboratory and in the field. Final report.** Winter, K.; Huang Pa. Niedersaechsische Forstliche Versuchsanstalt, Goettingen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1988. 35p. (In German). BMFT 0373215. Order Number DE90718061. Available from NTIS (US Sales Only), PC A03/MF A01.

The increasing soil acidity, but also the artificial liming against acidity change chemical and biological conditions of forest soils. Reactions of soil fauna in the field are different. Object of our researching is to test the effects of acid and lime in the laboratory and in the field on selected species of Collembola (Isotoma tigrina) and Onychiurus furcifer, and to develop standard methods for experimenting with and for breeding these species. Their preference to acid and lime was tested. In acidifying and liming experiments under labortory and field conditions, mortality and reproductivity of the two species were tested. In the laboratory heavy damages occured at very low (pH = 2) and very high pH-values. In the field damages were not noticed before 6 months after beginning the experiment. (orig.) With 23 refs., 2 tabs., 20 figs.

3763 (KFK-PEF–52) **Changes in ground vegetation of forest ecosystems in the middle and southern regions of the Black Forest.** Buerger, R. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre. Aug 1988. 229p. (In German). Contract PEF 84/019/1A. Order Number DE90718175. Available from NTIS (US Sales Only), PC A11/MF A01.

This study examines the changes in ground vegetation found in the Black Forest/West Germany in connection with the forest-decline ('Waldsterben'). To this end, the species composition was examined in areas of varying degrees of decline. Special attention was paid to ecological groups and their indications. These releves were compared laterally as well as with historical data. The focus of the analysis turned from sociological groups to specific species, whereby, on the basic of current literature on phytoindicators, the development of these species was recorded as a measure of pollutions impact. The altered composition of species exhibited itself in an increase in the high-nitrogen group in all of the communities. Similarly, in most communities an increase in the level of the reaction-group was observed. Evidence of succession due to acidification could not be significantly demonstrated. The observed changes were in accordance with the increase in the high-light group, except in the submountainous Luzulo-Fagetum. A comparison to the earlier proportional composition of ecological groups was used for more detailed interpretation. The observations indicate two primary influences on succession; first, increased levels of light, due to the thinning of the trees' crowns and second, increased levels of nitrogen due to pollution. (orig./MG) With 82 figs., 103 refs., 7 tabs. in annex.

3764 (LA–11474) **Attempted use of zinc in vivo to protect against nitrogen mustard toxicity in tumor-free and in L1210 leukemia-bearing B6D2F$_1$ mice.** Shackelford, M.E.; Tobey, R.A. Los Alamos National Lab., NM (USA). Dec 1989. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90002969. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The use of alkylating agents in treating cancer is limited by their toxicity to both normal and tumor tissue. Early in vitro and in vivo studies had indicated that zinc could be effective in mitigating this toxicity to normal tissue. The present studies were done to determine the capability of zinc to induce in living tissue a protective response to an alkylating agent, without also contributing to mortality. Tumor-free and leukemia-bearing B6D2F$_1$ mice were treated with zinc before administration of the alkylating agent nitrogen mustard (HN_2). Protocols for administration route and frequency and chemical formulation of the zinc were varied. The effect of a phytate-free diet was studied. Two parameters were used to judge the effectiveness of zinc in protecting animals from the toxicity of HN_2: the number of tumor-free mice who survived and any increase in the median life span of the tumor-bearing mice. Zinc provided a limited degree of protection against HN_2 toxicity in tumor-free mice, but in tumor-bearing animals, the protective response elicited with the protocols examined was too small to provide a significant therapeutic benefit. 6 refs., 3 figs., 2 tabs.

3765 (ORNL/M–948) **Biological (molecular and cellular) markers of toxicity: Semi-annual technical progress report (No. 2), April 1, 1989–September 30, 1989.** McCarthy, J.F. Oak Ridge National Lab., TN (USA). 1 Oct 1989. 21p. Sponsored by U.S. Department of Defense; U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE90002746. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objectives of this research are to evaluate the Japanese Medaka as a model for prediction of potential health effects from environmental contaminants. Progress to date has concentrated on efforts to describe the molecular and biochemical events resulting from exposure to a well-characterized model carcinogen, diethylnitrosamine (DEN). There are two goals underlying this approach. Fundamental understanding of the molecular and biochemical events underlying the carcinogenesis process in Medaka may make it possible to employ these responses as biomarkers estimate exposure and predict cellular effects of genotoxic chemicals. Thus, it may be possible to determine if an individual chemical, or waste effluent from Department of Defense facilities, poses a health threat based on exposure of Medaka to the contaminant for the short time required for the biomarker to respond, rather than for the six months required to evaluate a histopathological effect. More fundamentally, critical evaluation of the molecular carcinogenesis process in Medaka provides a foundation for using this convenient and cost-effective animal model for more directly extrapolating to human health effects, based on pharmacodynamic models. Before this approach could be accepted, it is necessary to demonstrate the molecular, biochemical and cellular events in carcinogenesis are similar in fish and humans. If the results of this research support such a conclusion, a later task of this project involves development of a pharmacodynamic model for extrapolating human health effects from bioassays using the Japanese Medaka. 1 fig., 4 tabs.

3766 (PB–89-218275/XAB) **Genetic activity profiles: Use in management of risk from genotoxic substances in the environment.** Waters, M.D.; Stack, H.F.; Brady, A.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 27p. (EPA–600/D-89/004). Available from NTIS, PC A03/MF A01.

A methodology has been developed to display and evaluate multiple test quantitative information on genetic toxicants for purposes of hazard/risk assessment. Genetic activity profiles were prepared which illustrate a quantitative data base on the genetic and related effects of nearly 200 chemicals for which some data are available on carcinogenicity in humans. This information may be used for purposes of comparative chemical-hazard assessment. Together with information derived from animal cancer tests and human epidemiological studies, assessments may be made regarding potential human health risks associated with exposure to chemical substances.

3767 (PB–89-218804/XAB) **Pathophysiological and disease constraints on aerosol delivery.** Gerrity, T.R. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects

Research Lab. 1989. 112p. (EPA–600/D-89/005). Available from NTIS, PC A06/MF A01.

The dose of inhaled particles to the respiratory tract depends upon many factors. These factors include the size of the particles, the pattern of breathing (flow and tidal volume), the physical properties of the articles (hygroscopic or non-hygroscopic), anatomy of the respiratory tract, and the pathophysiologic status of the respiratory tract. In addition to these factors, which are primarily related to the deposition of particles, the rate of particle clearance from the respiratory tract also influences the dose of particles. The paper is a review of the various factors influencing dose of inhaled particles to the respiratory tract. The emphasis of the paper is on therapeutic aerosol particles, though the principals discussed also apply to toxic particles as well. An important area of consideration is the influence of disease on the delivery of particle dose. From the point of view of toxic particles this is important when considering potential susceptible populations.

3768 (PB–89-218812/XAB) **Genetic-activity profiles and hazard assessment.** Waters, M.D.; STack, H.F.; Brady, A.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 6 Oct 1988. 27p. (EPA–600/D-89/007). Available from NTIS, PC A03/MF A01.

A methodology was developed to display and evaluate multiple-test quantitative information on genetic toxicants for purposes of hazard/risk assessment. Dose information is collected from the open literature: either the lowest effective dose (LED) or the highest ineffective dose (HID) tested is recorded for each agent and bioassay system. For each agent in the data base, the quantitative results from genetic and related test systems are represented by computer-generated bar graphs genetic activity profiles. The x-axis unit values correspond to approximately 200 different test systems. Bioassay systems are organized according to classes of genetic activity and subdivided by the phylogenetic level of the test organism. The y-axis values are the logarithmically transformed LED or HID values. Genetic activity profiles were prepared which illustrate a quantitative data base on the genetic and related effects of nearly 200 chemicals for which some data are available on carcinogenicity in humans. The information may be used for purposes of comparative chemical hazard assessment. Together with information derived from animal cancer tests and human epidemiological studies, assessments may be made regarding potential human health risks associated with exposure to chemical substances.

3769 (PB–89-220990/XAB) **Gastric response to methyl methacrylate vapor. Progress report.** Tansy, M.F. Temple Univ., Philadelphia, PA (USA). 29 Mar 1976. 6p. Available from NTIS, PC A02/MF A01.

The report summarizes the experiments designed to determine or confirm the effects of methyl methacrylate on the gastrointestinal system in dogs and rats. There is a direct action of methyl methacrylate on the gastrointestinal motor effector systems. Significant blood chemical changes were observed in rats exposed to 116 ppm of methyl methacrylate vapor in air for six months. Similar concentrations for three months caused reductions of visceral and subcutaneous fat, and after three and six months liver damage was observed.

3770 (PB–89-221014/XAB) **Walk-through survey report: Northeast Utilities Service Co./Stone and Webster Engineering Corp., Millstone Plant No. 3, Waterford, Connecticut, August 29, 1979.** Johns Hopkins Univ., Baltimore, MD (USA). 14 Dec 1979. 7p. Available from NTIS, PC A02/MF A01.

A walk-through survey of the Northeast Utilities Service Company's Millstone nuclear power facility in Waterford, Connecticut was conducted on August 29, 1979 to determine if the site would be suitable for inclusion in an in-depth epidemiological, industrial hygiene, and medical study of health hazards in the paint industry. The facility presently employs 23 painters. This total probably will increase to 150 during the final years of a construction program. Epoxy paints are the primary type of paint used and these are applied with brushes, rollers and spraying. Because of the highly detailed records kept at the site, and the type of paint used, it is concluded that the facility would be an excellent location to examine the exact exposures to individuals and to associate these exposures with health effects.

3771 (PB–89-221204/XAB) **Case-control study of bladder cancer in Massachusetts among populations receiving chlorinated and chloraminated drinking water.** Zierler, S.; Feingold, L.; Danley, R.A.; Craun, G. Brown Univ., Providence, RI (USA). Dept. of Community Health. 1989. 29p. Available from NTIS, PC A03/MF A01.

Studies of the occurrence of bladder cancer in relation to exposure to chlorinated drinking water, in general, have found a small excess frequency of bladder cancer among consumers of chlorinated drinking water. Despite near consistent findings of a small positive association, interpretation of the association has been cautious because of the inability to control for potential confounding by unmeasured differences in surface and ground water, as the index frequently used for exposure to levels of chlorination in drinking water compares chlorinated surface water to unchlorinated ground water. The authors undertook a case-control study to collect detailed data on residential history that was obtained from telephone interviews with informants of 614 individuals who died of primary bladder cancer and 1,074 individuals who died of other causes. The study was based in an area where surface water has been disinfected with either chlorine or a combination of chlorine and ammonia (chloramine) since 1938.

3772 (PB–89-222673/XAB) **Assessment of ecologic risks related to chemical exposure: Methods and strategies used in the United States.** Falco, J.W.; Moraski, R.V. Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment. May 1988. 16p. (EPA–600/D-89/069). Available from NTIS, PC A03/MF A01.

Pub. in Risk Management of Chemicals in the Environment, Vol. 12 of NATO: Challenges of Modern Society, Jan 1989.

The state-of-the-art assessment of risk to the ecosystem is still evolving. Although single-species tests have provided valuable information for the assessment of ecologic risk, it is necessary to focus on ecosystems-level tests and analyses. The increasing availability of predictive models makes assessment of risk to the environment, rather than simply to a single species, more possible. This paper presents a partial compilation of methods used in performing ecological risk assessments developed by the U.S. Environmental Protection Agency or published by the American Society for Testing and Materials and looks at the future directions of the EPA in the development of new ecological risk assessment methodologies and approaches.

3773 (PB–89-222707/XAB) **Methods used in the United States for the assessment and management of health risk due to chemicals.** Falco, J.W.; Moraski, R.V. Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment. May 1988. 27p. (EPA–600/D-89/070). Available from NTIS, PC A03/MF A01.

Pub. in Risk Management of Chemicals in the Environment, Vol. 12 of NATO: Challenges of Modern Society, Jan 1989.

A key factor in the development of a strategy for the control of environmental pollution or the protection of human health is the assessment of the risk associated with the accidental or intentional release of the chemical. A risk assessment may be used to estimate the degree of risk reduction that could result from the consideration of control scenarios that may be implemented in the regulatory process. As legislation and regulations have been enacted over the years to control chemical releases and to institute risk strategies, a diversity of approaches and technical quality in risk assessments resulted and complicated the management of environmental risks. This paper reviews the recent major U.S. reports on the issues of risk assessment and risk management and the response of federal agencies to the recommendations made in those reports. A more detailed description in this area is provided including as an example the recent risk assessment for dichloromethane (methylene chloride).

3774 (PB–89-222798/XAB) **Mutagenicity of combustion emissions from a biomedical-waste incinerator.** Driver, J.H.; Rogers, H.W.; Claxton, L.D. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 15p. (EPA–600/D-89/093). Available from NTIS, PC A03/MF A01.

The Ames Salmonella typhimurium (TA98) assay was used to determine the mutagenicity of stack fly ash from a medical/pathological waste incinerator. Stack fly ash also collected from a boiler plant adjacent to the incinerator and ambient air particles (upwind and downwind of the incinerator and boiler facilities) were collected and bioassayed. Downwind particulate mutagenicity (revertants per cubic meter of air) was significantly greater than upwind particulate mutagenicity. Mutagenic emission-rate estimates (revertants per kilogram waste feed) for the incinerator and boiler were less than estimates for ash and downwind ambient-air particulate samples collected during incinerator auxiliary burner failure and demonstrated significant increase in mutagenicity compared to samples collected during routine incinerator operation.

3775 (PB–89-222830/XAB) **Use of genotoxic activity profiles in assessment of carcinogenesis and transmissible genetic effects.** Waters, M.D.; Stack, H.F.; Brady, A.L. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1988. 27p. (EPA–600/D-89/087). Available from NTIS, PC A03/MF A01.

A methodology has been developed to display and evaluate multiple test quantitative information on genetic toxicants for purposes of assessing carcinogenesis and transmissible genetic effects. Genetic activity profiles were prepared which illustrate a quantitative data base on the genetic and related effects of nearly 200 chemicals for which some data are available on carcinogenicity in humans. This information may be used for purposes of comparative chemical hazard assessment. Together with information derived from animal cancer tests and human epidemiological studies, assessments may be made regarding potential human health risks associated with exposure to chemical substances.

3776 (PB–89-223606/XAB) **Detection of genetic hazards from environmental chemicals with plant test systems.** Gill, B.S.; Sandhu, S.S. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 45p. (EPA–600/D-89/062). Available from NTIS, PC A03/MF A01.

This book chapter reviews the methodology and utility of five plant bioassays for detecting the mutagenicity of environmental chemicals. The bioassays described in this chapter are Vicia faba root tip, Tradescantia micronucleus for chromosome aberrations, tradescantia stamen hair, Arabidopsis embryo for gene mutation, and wheat seedling assay for aneuploidy.

3777 (PB–89-223630/XAB) **Effects of atmospheric mix and toxic fumes on military performance.** Benignus, V.A. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 85p. (EPA–600/D-89/060). Available from NTIS, PC A05/MF A01.

The individual and combined neurobehavioral effects of carbon monoxide, hydrogen cyanide, carbon dioxide and hypoxic hypoxia are discussed. The effects of each are reviewed separately, and then the literature of the effects of combined exposures were covered. The latter is a relatively sparse literature. The empirical and physiological information available was encoded as a series of dose-effects and pharmacokinetic equations. Assuming additive effects, a mathematical model was proposed for the combined exposure. Several pharmacokinetic interactions make the received dose of the combined pollutants nonadditive, however, and thus introduce nonadditivity into the combined model. The model was useful in pointing out the kind of information still needed to make predictions. The model thus serves a mainly heuristic purpose.

3778 (PB–89-223804/XAB) **Structural properties for determining mechanisms of toxic action.** Bradbury, S.P.; Lipnick, R.L. Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab. 1989. 10p. (EPA–600/D-89/089). Available from NTIS, PC A02/MF A01.

The results of a workshop co-sponsored by EPA through the Health and Environmental Review Division, Office of Toxic Substances and the Environmental Research Laboratory-Duluth, of the Office of Research and Development are briefly summarized as an introduction to a series of manuscripts dealing with the structural properties of chemicals that determine their toxic mechanisms. Results of the workshop are intended to be incorporated in an expert system to predict mechanisms from chemical structure and aid in predictive toxicology applications in the Agency. The goal of the workshop was to review current understanding of fundamental mechanisms, and develop an initial knowledge base on chemical features and properties from which toxic mechanisms could be predicted from structure. Areas addressed included general anesthesia, or narcosis, oxidative phosphorylation uncoupling, electrophile and free-radical reactivity, and a variety of pesticide-based mechanisms.

3779 (PB–89-223952/XAB) **Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures.** Stara, J.F.; Bruins, R.J.F.; Dourson, M.L.; Erdreich, L.S.; Hertzberg, R.C. Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment. 1989. 28p. (EPA–600/D-89/033). Available from NTIS, PC A03/MF A01.

Pub. in Methods for Assessing the Effects of Mixtures of Chemicals, 719-743(1987).

The US Environmental Protection Agency is engaged in the development of risk-assessment guidelines and methodologies as part of the regulatory program of the Agency. The primary goal of the Agency was originally to accurately assess the effects of human exposure to single chemicals in a single medium (e.g. water) over a human lifetime. Assessment methods for estimating low-dose lifetime cancer risk for known or suspected human carcinogens, or long-term acceptable daily intake (ADI) levels for threshold-acting toxicants, were developed and successfully applied to meet this need. Now there is an increasing need for methods which address more complex exposure situations, including multichemical, multiroute, and partial-lifetime exposures. Improvements in the current methods are also needed. Several issues now under study are briefly described.

3780 (PB–89-223986/XAB) **Electrophysiological systems for neurotoxicity field testing: PEARL II and alternatives.** Otto, D.A.; Hudnell, H.K. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 10 Feb 1989. 22p. (EPA–600/D-89/092). Available from NTIS, PC A03/MF A01.

PEARL II, a computerized battery of electrophysiological tests designed for neurotoxicity field testing, was developed a decade ago. The battery includes sensory evoked potentials (auditory, somatosensory, and visual), event-related slow brain potentials (CNV, P300), and associated behavioral measures. Field-testing capabilities have been demonstrated in pediatric lead studies. Several dozen PEARL II systems are currently being used in fixed-base laboratories. Factors which limit the use of PEARL II in neurotoxicity field testing include: operation and maintenance of the system requires a highly trained staff; PEARL II is a relatively expensive system; it is not commercially available or serviced; the hardware is obsolescent. Although sensory-evoked potential tests have proven to be very sensitive to chemical exposure in humans and animals, the effectiveness of such tests for neurotoxicity screening of exposed populations has not been demonstrated. Several commercial systems suitable for neurotoxicity field testing are reviewed briefly. Electrophysiological tests of visual toxicity currently under development are also described.

3781 (PB–89-224554/XAB) **Chronic exposure to ozone causes restrictive lung disease.** Grose, E.C.; Costa, D.L.; Hatch, G.E.; Miller, F.J.; Graham, J.A. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 11p. (EPA–600/D-89/102). Available from NTIS, PC A03/MF A01.

A chronic study to determine the progression and/or reversibility of ozone-induced lung disease was conducted. Male rats were exposed to a diurnal pattern of ozone (O_3) for 1 week, 3 weeks, 3 months, 12 months, or 18 months. The occurrence of chronic lung disease was determined by structural and functional endpoints. Structurally, a biphasic response was observed with an initial acute inflammatory response after 1 week of exposure, a reduced acute response after 3 weeks of exposure, and an epithelial and interstitial response observed after 3 months which persisted or increased in intensity up to 18 months of exposure. Functional studies showed a persistence of decreased total lung capacity and residual volumes at 3, 12, and 18 months of exposure, a response indicative of restrictive lung disease. Biochemical changes in antioxidant

metabolism were also observed after 12 and 18 months of exposure. Most significant changes were resolved after the clean-air recovery period. The study has shown that chronic exposure to O_3 causes restrictive lung disease as characterized by the development of focal interstitial fibrosis.

3782 (PB–89-224570/XAB) **Application of a simple short-term bioassay for the identification of genotoxins from hazardous wastes.** Sandhu, S.S.; Acedo, G.N. Environmental Health Research and Testing, Inc., Research Triangle Park, NC (USA). 1989. 12p. Available from NTIS, PC A03/MF A01.

The proper disposal of hazardous wastes currently generated and cleanup of waste disposal sites of the past are challenges facing regulatory agencies in the industrialized nations. The estimation of levels of toxicity is an essential step in prioritizing industrial effluents and solid wastes for treatment and disposal. A number of short-term bioassays have been developed to supplement information from chemical analysis for evaluating the potential of chemical complex mixtures to induce adverse human health effects and environmental contamination. Among these bioassays, plant test systems provide simple, inexpensive, and rapid means of evaluating toxic effects of industrial wastes based on multimedia exposure. Two such assays, Tradescantia paludosa and Zea mays, have been used for monitoring the genotoxic effects of ambient air, municipal wastes, industrial effluents, solid wastes, water sediments, and pesticides. The Arabidopsis embryo assay was applied to evaluate the mutagenicity of complex environmental mixtures including industrial effluents and sludges. The industrial-waste samples were tested either unextracted or as dichloromethane aqueous extracts. The significance of short-term plant bioassays for use in environmental assessment will be discussed.

3783 (PB–89-224588/XAB) **Estimating human-equivalent no observed adverse-effect levels for VOCs (volatile organic compounds) based on minimal knowledge of physiological parameters. Technical paper.** Overton, J.H.; Jarabek, A.M. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 15p. (EPA–600/D-89/097). Available from NTIS, PC A03/MF A01.

The U.S. EPA advocates the assessment of health-effects data and calculation of inhaled reference doses as benchmark values for gauging systemic toxicity to inhaled gases. The assessment often requires an inter- or intra-species dose extrapolation from no observed adverse effect level (NOAEL) exposure concentrations in animals to human equivalent NOAEL exposure concentrations. To achieve this, a dosimetric extrapolation procedure was developed based on the form or type of equations that describe the uptake and disposition of inhaled volatile organic compounds (VOCs) in physiologically-based pharmacokinetic (PB-PK) models. The procedure assumes allometric scaling of most physiological parameters and that the value of the time-integrated human arterial-blood concentration must be limited to no more than to that of experimental animals. The scaling assumption replaces the need for most parameter values and allows the derivation of a simple formula for dose extrapolation of VOCs that gives equivalent or more-conservative exposure concentrations values than those that would be obtained using a PB-PK model in which scaling was assumed.

3784 (PB–89-224596/XAB) **Complex mixtures of urban air pollutants: identification and comparative assessment of mutagenic and tumorigenic chemicals and emission sources.** Lewtas, J.; Gallagher, J. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. 1989. 23p. (EPA–600/D-89/098). Available from NTIS, PC A03/MF A01.

Advances in the cancer risk assessment of complex mixtures of urban air pollutants requires the development of new methods in predicting human risk. Current research is focusing on the identification and source apportionment of airborne carcinogens and the development of new exposure, dosimetry and extrapolation methods which can be applied to complex mixture problems. Research on the identification of the genotoxic compounds in urban air and particularly on the polar mutagenic compounds, many of which appear to be nitrated and or oxygenated aromatic compounds, is advancing with the use of micromutagenesis methods coupled to analytical fractionation and new chemical characterization methods. Source apportionment of the mutagenic activity observed in urban air shows that the small-area combustion sources, vehicles and residential heating, are the major contributors to the ambient mutagenicity of the aerosol fraction. The potential hazard and sources of the gaseous emissions appear to be significantly increased by atmospheric transformation by ozone and nitrogen oxides. Studies are being conducted with current environmental combustion emission sources and urban aerosol samples as well as with emission sources for which human lung-cancer data and human tissues are available for comparative assessment.

3785 (PB–89-225403/XAB) **Toxicological profile for selected PCBs (polychlorinated biphenyls) (Aroclor-1260, -1254, -1248, -1242, -1232, -1221, and -1016). Final report.** Syracuse Research Corp., NY (USA). Jun 1989. 146p. Available from NTIS, PC A07/MF A01.

The Toxicological Profile for selected PCBs is intended to characterize succinctly the toxicological and health effects information for the substance. It identifies and reviews the key literature that describes the substance's toxicological properties. The profile begins with a public-health statement which describes in nontechnical language the substance's relevant toxicological properties. Following the statement is material that presents levels of significant human exposure and, where known, significant health effects. The adequacy of information to determine the substance's health effect is described as well as research gaps in nontoxic and health-effects information. Research gaps that are of significance to the protection of public health will be identified in a separate effort. The focus of the document is on health and toxicological information.

3786 (PB–89-225627/XAB) **EPA (Environmental Protection Agency) programs and the regulation of carcinogens: Methods and philosophies. Technical report.** Jackson, M.; Johnson, L.; Kelly, J.; Ledeboer, T.; Malave, M. Drexel Univ., Philadelphia, PA (USA). Environmental Studies Inst. 1988. 124p. Available from NTIS, PC A06.

Portions of this document are not fully legible.

This paper discusses the manner in which the EPA identifies, assesses risk for, and regulates substances determined to cause cancer in humans. The report provides an overall perspective of the carcinogen standard-setting process as it is affected by scientific, legal, and political influences. Discussed are: history and methods of carcinogen regulation; toxicological methods for determining carcinogenicity; the use of human-exposure data to regulate carcinogens; an overview of the agency's system for classifying chemical agents suspected or known to cause cancer; significant Federal court cases and decisions that have influenced attempts by Federal agencies to regulate carcinogens; and factors affecting EPAs regulation of carcinogens.

3787 (PB–89-227862/XAB) **Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977.** Frank, R.; Morgan, M.S.; Koenig, J.Q.; Horike, N.; Covert, D.S. Washington Univ., Seattle, WA (USA). Dept. of Environmental Health. Jul 1977. 57p. Available from NTIS, PC A04/MF A01.

This study shows the effects of exposure to combinations of sulfur dioxide with sodium sulfate or ammonium sulfate at controlled relative humidities on the respiratory systems of animals or man. Female COBS guinea pigs were exposed to 5 parts per million (ppm) SO_2, 1 mg/m^3 ammonium sulfate, or ammonium sulfate plus 1, 5 or 10 ppm SO_2. When SO_2 was given alone, the effects implicated the upper and/or central airways and occurred early in the exposure period. Effects associated with ammonium sulfate exposure implicated the peripheral airways and either appeared or extended into the latter half of the exposure period. For human studies, 18 nonsmoking adults were exposed to a droplet aerosol of ammonium sulfate (1.0 mg/m^3) alone, a dry aerosol of ammonium sulfate plus SO_2, or a droplet aerosol of ammonium-sulfate plus SO_2. In these healthy subjects, the average short-term effects of the two inhaled agents, alone or combined, were slight. Ammonium sulfate was mildly irritating alone, but did not show evidence of biological interaction with SO_2. No evidence for additive or synergistic action was noted.

3788 (PB–89-230551/XAB) **Accumulation patterns of heavy metals and chlorinated hydrocarbons by sea otters, Enhydra lutris, in California. Final report.** Risebrough, R.W. California

Univ., Santa Cruz, CA (USA). Inst. of Marine Sciences. 30 Jun 1989. 53p. Available from NTIS, PC A04/MF A01.

Chemical contaminants and naturally occurring toxic compounds in the coastal ecosystem of California currently inhabited by sea otters, Enhydra lutris, do not appear to have, or have had, any effect on the status of the population. Ratios of pups to adults appear to be within the expected ranges and do not indicate any depressed productivity that might be caused by one or a combination of environmental toxicants. Polychlorinated biphenyls (PCBs), however, which cause nearly complete reproductive failures when fed at levels as low as 0.6 ppm in another member of the family Mustelidae, the mink, Mustela vison, were present in livers of a number of animals at higher levels than those associated with reproductive failure in mink. An interspecific difference in sensitivity, or relatively lower amounts of the more toxic PCB compounds in the sea otter population, is indicated. A decline in PCB (and DDE) levels along the California coast recorded in mussels, Mytilus californianus, and the ending of PCB uses reduce any potential threat to the otter population from PCB contamination.

3789 (PB–89-871214/XAB) **Toxicity: Polymeric materials in food-contact applications. January 1977-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1977-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 108p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868542.

This bibliography contains citations concerning toxicity investigations of polymeric materials in food-contact applications. Polymeric food-packaging materials and regulations are discussed. Toxicity testing, polymeric equipment in food processing, and the use of additives in food packaging are included. Discussions also include coating materials for food containers and pigments for food packaging films. (This updated bibliography contains 275 citations, 10 of which are new entries to the previous edition.)

3790 (PB–89-900300/XAB) **Registry of Toxic Effects of Chemical Substances (RTECS), 1988 computer tape. Data file.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Apr 1989. mag ta Available from NTISSubscription.

Supersedes PB–87-900300. Source tape is in the EBCDIC character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB–87-222246. Available on subscription, North American Continent price $2000.00/year; all others write for quote. Issued quarterly.

The tapes contain the data and bibliographic CODEN files of the 1986 Registry of Toxic Effects of Chemical Substances (RTECS). The Registry is an annual compendium of toxicity data abstracted from the scientific literature by the National Institute for Occupational Safety and Health (NIOSH) in compliance with the Occupational Safety and Health Act of 1970. For each compound, the following data are provided: prime name and synonyms, CAS number, molecular weights and formulas, date when substance record was last updated, Wiswesser Line Notations irritation, mutation, reproductive effects, tumorigenic, and toxic dose data with references; toxicology reviews; carcinogenic assessments; government standards and regulations; ACGIH-Threshold Limit Values; NIOSH Recommended Exposure Limits; Current Intelligence Bulletins and Analytical Methods; NTP bioassay results; and EPA status.

3791 (UCID–21822) **Environmental considerations for the conduct of surrogate tests in the Engineering Demonstration System.** Mode, V.A. Lawrence Livermore National Lab., CA (USA). Oct 1989. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-48. Order Number DE90001790. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An evaluation of a number of environmental factors shows that the incremental increases due to rare-earth testing in the Engineering Demonstration System (EDS) are insignificant. The conduct of tests would neither require the construction of new facilities nor modification of existing LLNL facilities. All wastes generated by tests would be within established LLNL operational capabilities and environmental or safety impacts have been identified. 2 figs., 3 tabs.

3792 (UCID–21823) **A review of the literature on the toxicity of rare-earth metals as it pertains to the Engineering Demonstration System surrogate testing.** Wald, P.H. Lawrence Livermore National Lab., CA (USA). Oct 1989. 27p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-48. Order Number DE90001789. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A review of data on animal and damaging human exposure to the rare-earth elements has been made. Incidental oral ingestion is considered to be harmless and accidental nonrespiratory uptake does not represent a health risk. Equipment design and operating procedures mitigate against dermatologic or ophthalmologic risk to workers and the public. Animal and human inhalation studies confirm the use of the Threshold Limit Value-Time Weighted Average (TLV-TWA) for yttrium as a conservative measure for evaluation of the Engineering Demonstration System (EDS) emission of the lanthanons. This value (1 mg/m^3) is also consistent with the OSHA-established permissible exposure limit (PEL). Environmental exposures that are maintained at a level below the TLV/PEL value should result in no health impact to workers, visitors, or the public. 38 refs., 7 tabs.

3793 **Asbestos cement dust inhalation by hamsters.** Wehner, A.P. (Pacific Northwest Laboratories, Richland, WA (USA)); Dagle, G.E.; Cannon, W.C.; Buschbom, R.L. *Environmental Research (USA),* 17(3): 367-389 (Dec 1978).

Two groups of 96 male Syrian golden hamsters were exposed to respirable asbestos cement aerosol at concentrations of approximately 1 and approximately 10 micrograms/liter, respectively, 3 hours/day, 5 days/week. Average fiber counts ranged from 5 to about 120 fibers/cm3. Each group was randomly divided into six subgroups of 16 animals. The first subgroup was sacrificed after 3 months of exposure, the second after 6 months, and the third after 15 months. The fourth subgroup was withdrawn from exposure after 3 months, observed for an additional 3 months, and then sacrificed. The fifth and sixth subgroups were withdrawn after 3 and 6 months of exposure, respectively, and maintained for observation up to the 15-month exposure point of the third subgroup at which time all surviving animals were sacrificed. All other experimental procedures were similar to those delineated in a previous publication describing the development of an animal model, techniques, and an exposure system for asbestos cement dust inhalation. The asbestos cement exposures had no significant effect on body weight and mortality of the animals. Higher aerosol concentration and longer exposure times increased the number of macrophages and ferruginous bodies found in the lungs of the exposed animals. Recovery periods had no effect on the incidence of macrophages and ferruginous bodies. The incidence of very slight to slight fibrosis in the animals sacrificed after 15 months of exposure shows a significant (P less than 0.01) trend when the untreated control group and the 1 and 10 microgram/liter dose level groups are compared, indicating a dose-response relationship. Development of minimal fibrosis continued in animals withdrawn from exposure. No primary carcinomas of the lung and respiratory tract and no mesotheliomas were found.

3794 **Production of oxidative DNA damage during the metabolic activation of benzo[α]pyrene in human mammary epithelial cells correlates with cell killing.** Leadon, S.A. (Lawrence Berkeley Lab., CA (USA)); Stampfer, M.R.; Bartley, J. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(12): 4365-4368 (Jun 1988). DOE Contract AC03-76SF00098.

The authors have studied the generation of reactive oxygen species during the metabolism of a carcinogen, benzo[α]pyrene, by human mammary epithelial cells. They have quantitated the production of one type of oxidative DNA damage, thymine glycols, by using a monoclonal antibody specific to this base modification. Thymine glycols were produced in DNA in a dose-dependent manner after exposure of human mammary epithelial cells to benzo[α]pyrene. The number of thymine glycols formed in the DNA was similar to that of 7,8-dihydroxy-9,10-epoxy-7,8,9,10-tetrahydrobenzo[α]pyrene covalently bound to the DNA. Exposure of cells to the carcinogen in the presence of superoxide dismutase, which reduced superoxide anions, inhibited the production of thymine glycols and increased cell survival but had little effect on adduct formation. At equitoxic

doses, ≈10-fold more thymine glycols were formed after exposure to benzo[α]pyrene than to γ-irradiation. Thymine glycols, produced by either agent, were efficiently removed from the DNA of the cells. Since thymine glycols represent only a portion of the oxidative damage possibly produced, the results indicate that the total amount of oxidative damage induced during the exposure of human mammary epithelial cells to benzo[α]pyrene greatly exceeds the amount produced by direct adduct formation and that this indirect damage plays an important role in the cytotoxicity of benzo[α]pyrene.

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 2425, 2675

3795 (AD-A–210200/2/XAB) **ELF (extremely low frequency) communications system ecological monitoring program: Electromagnetic field measurements and engineering support – 1988. Technical report, 1982-1988.** Haradem, D.P.; Gauger, J.R.; Zapotosky, J.E. IIT Research Inst., Chicago, IL (USA). May 1989. 306p. (IITRI-E–06595-5). Available from NTIS, PC A14/MF A01.

A long-term program for studying possible effects from the operation of the Navy's ELF Communications System is being conducted on biota and ecosystems components in northwestern Wisconsin and the Upper Peninsula of Michigan. Sixteen general types of organisms from three major ecosystems in the ELF system area are being examined. Formulation of an ELF Ecological Monitoring Program was completed in early 1982 by the Department of the Navy, and studies were initiated in late summer of the same year. Beginning in 1983 and continuing during 1984, major activities of the program consisted of characterization of critical aspects of each study, collection of data to validate assumptions made in proposals, and selection of study sites. From 1985 through 1988, activities centered on the operation of full-scale studies. This report documents electromagnetic (EM) field measurements at investigator selected study sites from 1982 through 1988. Other engineering support activities are also described.

3796 (AD-A–210267/1/XAB) **Behavioral measurement of laser flashblindness in rhesus monkeys. Final report, June-August 1985.** Rhodes, J.W.; Garcia, P.V.; Cosgrove, D.J. Krug International, San Antonio, TX (USA). Technology Services Div. Aug 1985. 7p. Available from NTIS, PC A02/MF A01.

Flashblindness was measured in rhesus monkeys performing a visual-detection task. Stimulus field subtense was 3.5, and a mean luminance was 10 cd/m^2. Laser exposures (doubled Nd:glass, 530-nm wavelength, 20-ns pulsewidth) were presented in Maxwellian view and formed a 12.5 diameter spot centered on the fovea. The independent variables were: (1) test grating contrast (10%, 98%); (2) test grating spatial frequency (1, 4, 12 c/deg); and (3) laser exposure average energy (1% to 94% retinal maximum permissible exposure). The dependent variable was flashblindness, operationally defined as the time between a laser exposure and the first response in a pair of consecutive correct responses (referred to as time to criterion).

3797 (AD-A–210284/6/XAB) **Treatment of laser-induced retinal injuries. Final report, 12 February 1985-31 January 1987.** Belkin, M.; Naveh, N. Tel Aviv Univ. (Israel). 29 Jun 1989. 36p. Available from NTIS, PC A03/MF A01.

This study investigated the effect of steroids know for their inflammatory effect on the laser-induced retinal injury. In an attempt to minimize this, the authors studied prostaglandin E2 (PGE2), known for their mediatory role in any inflammatory reaction, as well as changes in protein leakage. The latter is indicative of blood retinal barrier disruption. The study revealed an enhanced PGE2 response as manifested by: (1) excessive production in vitro of PGE2 by the retina/choroid of laser-exposed eyes; (2) accumulation of both PGE2 and protein in the vitreous body to above prelaser values. Corticosteroid treatment abolished the increase in the vitreal PGE2 response, but it only partially reduced the excessive PGE2 production in vitro by retina/choroid. Treatment was effective during the first week, but later failed. The finding of the transient nature of the anti-PGE2 effect of the steroids does not necessarily point to the steroids inefficacy as anti-inflammatory agents, but rather may point to the cytoprotective nature of PGs themselves.

3798 (AD-A–210599/7/XAB) **Eye/sensor protection against laser irradiation: Organic nonlinear optical materials. Final report, April-December 1988.** Boyle, M.E.; Cozzens, R.F. Naval Research Lab., Washington, DC (USA). 12 Jun 1989. 100p. (NRL-MR–6482). Available from NTIS, PC A05/MF A01.

Recent developments in organic nonlinear optical materials for application to eye and sensor protection are reviewed. This compendium includes a brief discussion of the functioning of the eye, delineation of some of the important eye-protection parameters, and an introduction to the origin of nonlinear optical effects and how they are measured. Specific examples of proposed or prototyped protection devices are also presented. A compilation of noteworthy organic third-order nonlinear optical materials is included as an appendix. Lasers are playing an important and increasing role in modern society. Their present uses range from compact-disc players to optical data-storage and communication systems. Because of this wide-spread use, the continuing expansion of lasers into other arenas and the low-damage thresholds of human eyes and electro-optic sensors, there is increasing concern about eye and sensor protection from laser irradiation.

3799 (AD-A–210698/7/XAB) **Thermodynamic principles of the process of the effect of electromagnetic fields on a polymer melt.** Miroshnichenko, V.F.; Semenyuk, N.I. Foreign Technology Div., Wright-Patterson AFB, OH (USA). 23 Jun 1989. 12p. (FTD-ID(RS)T–1133-88). Available from NTIS, PC A03/MF A01.

Partially edited machine trans. of Plasticheskiye Massy (USSR), No. 10, 35-36(1970).

The effect of electromagnetic fields on a polymer melt leads to an increase in the strength of polymers while magnetostatic field virtually does not have an effect on the immobile polymer melt. However, if relative motion of magnetic field and polymer melt occurs, then, according to the laws of electrodynamics, besides magnetic field in the polymer melt appears the electric field, which will interact with the macromolecules of polymer. As a result of this can be changed the structure of polymer melt, which will be fixed/recorded in proportion to cooling fusion/melt, which must immediately be reflected in the properties of solid polymer. Change in structure of polymer melt can be considered as peculiar phase transitions. Apparently, for the polymer melts besides the phase transformations of the first and second kind there are other, possibly, mixed phase transitions. We experimentally established presence of Delta T-effect in polymer melts, which is characteristic for phase second-order transformations. Therefore in this article we use theory of second-order phase transitions in application to the phenomena in question.

3800 (BFR-R–49-1989) **Effects on zooplankton when passing through an open lake water heat pump.** Laennergren, C. Swedish Council for Building Research, Stockholm (Sweden). 1989. 26p. (In Swedish). Order Number DE90719422. Available from NTIS (US Sales Only), PC A03/MF A01.

The report deals with lake water heat pumps with an open system that can utilize a comparatively large fraction of the available volume in a lake. Organisms, which follow the water through the system, may be injured during the passage of the tubes, pumps and heat exchangers. Three types of influences have been studied: Momentary death, egg losses and injuries observed in the microscope. Long-term effects have been studied through follow-up of changes in the fraction of dead individuals during up to seven days. Taken together, the effects from the heat pump at the investigated locality is regarded as small. Care is recommended at siting of heat pumps with recirculation. Injuries varied from broken antennas to halved, decapitated or completely crushed individuals. The most common injury was broken posterodorsal spine in Daphnia, which at direct through-flow, without recirculation, increased with 6-20%. Recirculation resulted in a marked greater occurrence of injuries, and the fraction of injured Daphnia increased with approx. 50%. The rise in the number of dead individuals was approx 5-30% at direct through-flow. With recirculation the mortality was 100% for Chydorus, 50% for Nauplier and Cyclops, and 30% for Bosmina. Cyclops was the only species with egg carrying females in any numbers. The fraction of egg carrying individuals decreased at two samples, from 12 to 4% and 29 to 21% respectively. Recirculation caused total loss of eggs. The survival experiments gave diffuse and partly unexplainable results. The increase in the fraction of

dead individuals was not greater in the samples with water that had passed the heat pump than in unaffected water.

3801 (CONF-8910193–4) **Development of a centralized solvent recovery system at Carswell Air Force Base.** Summers, J.R.; Nicholas, W.D.; Tull, D.E. Oak Ridge National Lab., TN (USA). Hazwrap Support Contractor Office. [1989]. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. From DOE model conference; Oak Ridge, TN (USA); 2-6 Oct 1989. Order Number DE90003060. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

With current regulatory trends, waste minimization has received increased attention during the last several years. The US Air Force has implemented waste minimization studies at Strategic Air Command bases to select options to reduce the volume of generated hazardous waste and develop ongoing waste minimization programs. This paper provides an overview of the study conducted at Carswell Air Force Base and focuses on the aspects of the development of the central recycle center waste minimization option. 1 fig., 1 tab.

3802 (LBL–27867) **The influence of oscillating electromagnetic fields on membrane structure and function: Synthetic liposome and natural membrane bilayer systems with direct application to the controlled delivery of chemical agents.** Liburdy, R.P.; de Manincor, D.; Fingado, B. Lawrence Berkeley Lab., CA (USA). Sep 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8905236–1: Royal Swedish Academy of Sciences symposium on interaction mechanisms of low-level electromagnetic fields, Stockholm (Sweden), 25-27 May 1989). Order Number DE90002454. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Investigations have been conducted to determine if an imposed electromagnetic field can influence membrane transport, and ion and drug permeability in both synthetic and natural cell membrane systems. Microwave fields enhance accumulation of sodium in the lymphocyte and induce protein shedding at Tc. Microwaves also trigger membrane permeability of liposome systems under specific field exposure conditions. Sensitivity varies in a defined way in bilayers displaying a membrane structural phase transition temperature, Tc; maximal release was observed at or near Tc. Significantly, liposome systems without a membrane phase transition were also found to experience permeability increases but, in contrast, this response was temperature independent. The above results indicate that field-enhanced drug release occurs in liposome vesicles that possess a Tc as well as non-Tc liposomes. Additional studies extend non-Tc liposome responses to the in vivo case in which microwaves trigger Gentamicin release from a liposome "depot" placed subcutaneously in the rat hind leg. In addition, evidence is provided that cell surface sequestered liposomes can be triggered by microwave fields to release drugs directly into target cells. 24 refs., 6 figs.

57 HEALTH AND SAFETY

Refer also to citation(s) 3685, 3758

3803 (LIS–84) **Hints and search strategies for the substances listed in the Accident Ordinance.** Wefers, H.; Schulz, T.; John, R. Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.). 1988. 238p. (In German). Available from Available from Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.).

The Accident Ordinance of 1980 (BGBl. I, p. 772) (Stoerfall-Verordnung 80) was amended by the new version of 19 May 1988 (BGBl. I, p. 625) (Stoerfall-Verordnung 88), which came into force on 1 September 1988. While the older version listed 142 hazardous substances and groups of substances, the new version contains a list of 320 hazardous substances and groups of substances. Both lists are presented in the report. On the basis of these lists, the Zentralstelle Stoerfallverordnung und gefaehrliche Stoffe (ZStVO) of the LIS established a rational database of hazardous substances, which can be operated on PC with hard disk and MS-DOS (IMB-compatible). This report addresses licensing and supervisory authorities as well as operators of plants subject to the Accident Ordinance. Registers of trivial names and trade names facilitate access to the substances. (orig./HP).

58 GEOSCIENCES

5801 Geology and Hydrology

Refer also to citation(s) 3042, 3057, 3059, 3060, 3061, 3394, 3395, 3811, 4065

3804 (PNCT-N–8410-89-010) **Natural analogue study of volcanic glass. A case study of basaltic glasses in pyroclastic fall deposits of Fuji volcano, Japan.** Arai, T.; Yusa, Y.; Sasaki, N.; Tsunoda, N.; Takano, H. Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan). Feb 1989. 16p. (CONF-881066–: 12. international symposium on the scientific basis for nuclear waste management, Berlin (Germany, F.R.), 10-13 Oct 1988). Order Number DE90719553. Available from NTIS (US Sales Only), PC A03/MF A01.

A considerable range in alteration rates of basaltic glasses in various environments has been reported in previous studies. However, these studies paid only cursory attention to the environmental conditions under which the glass had been altered. In this study, the alteration of basaltic glasses was investigated and the environmental conditions and the alteration rate were discussed. Two sample ages were represented: 280 years and 2800 years. Basaltic glasses and their alteration layers were analyzed by electron probe microanalyzer (EMPA) and the thickness of the alteration layers were measured by scanning electron microscope (SEM). The ground water collected near the sampling point of Zunazawa Scoria (2800 years) and the pore water of both samples were analyzed. The alteration temperature and flow rate of water are estimated to be about 13degC and 0.2 $l/cm^2/y$ respectively on the basis of meteorological data. The alteration layers of young aged basaltic glasses in freshwater conditions are similar to those of leached borosilicate glasses. The alteration rates of these basaltic glasses are estimated to be several $\mu m/1000y$. The elemental concentrations in the ground water can be roughly explained as the result of leaching of the glasses. (author).

5802 Geophysics

Refer also to citation(s) 2526, 3560

3805 (DOE/ER/13472–3) **Rapid inversion of multi-dimensional magnetotelluric data.** Smith, J.T. Washington Univ., Seattle, WA (USA). Aug 1988. 160p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-86ER13472. Order Number DE90003659. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This dissertation addresses the problem of computationally efficient ways to recover the distribution of the earth's electrical conductivity as a function of position from magnetotelluric (MT) data, for one-, two-, and three-dimensional conductivity distributions. A method is developed for inversion of two-dimensional data that is roughly 70 times faster per iteration than standard methods of inversion for small sized problems, with increased savings for larger problems. Approximate partial derivatives of MT data with respect to the conductivity directly beneath it are obtained from a perturbation argument in which only cross terms involving both horizontal gradients and variations in conductivity are neglected. At each iteration of the method the partial derivatives are used in single site inversions at each site, the conductivity profiles below the various sites interpolated to obtain a 2-D model, and 2-D forward modeling performed to obtain a new set of residuals. The rapid inversion method is demonstrated in several inversions of synthetic data. The rapid method is extended to inversion of 3-D data in two different manners; one using single site inversions and the other using multiple site inversions. Estimated operation counts are down by factors of 500 and 80, respectively, from 3-D inversions formulated in a conventional manner, making three-dimensional inversion affordable on current day computers. Our implementation of the rapid method makes use of a general purpose linear inversion that can minimize

weighted norms of a model or its first or second derivatives and may be used in conventional inversions of one- and two-dimensional MT data. Step size control is particularly important for assuring the improvement of an objective function when the general purpose inversion is used in an iterative nonlinear inversion. Nonlinear 1-D MT inversions are also discussed briefly.

3806 (DOE-tr–89-0021) **Construction standards and practices, SNIP II-7-81: Part 2, Design standards: Chapter 7, Construction in seismic regions.** USDOE, Washington, DC (USA). 1989. 52p. Translated from Gosstroy SSSR, Moscow, 1982, pp 1-26. Sponsored by U.S. DOE Management & Administration. Order Number DE90002699. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The standards of chapter 7 (Construction in seismic regions) of the Construction Standards and Practices manual can be useful in the design of buildings in seismic areas. (JF)

3807 (EGG-M–89182) **Earthquake strong ground motion studies at the Idaho National Engineering Laboratory.** Wong, I.; Silva, W.; Darragh, R.; Stark, C.; Wright, D.; Jackson, S.; Carpenter, G.; Smith, R.; Anderson, D.; Gilbert, H. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8910192–15: 2. DOE natural phenomena hazards mitigation conference, Knoxville, TN (USA), 3-5 Oct 1989). Order Number DE90002029. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Site-specific strong earthquake ground motions have been estimated for the Idaho National Engineering Laboratory assuming that an event similar to the 1983 M_s 7.3 Borah Peak earthquake occurs at epicentral distances of 10 to 28 km. The strong ground motion parameters have been estimated based on a methodology incorporating the Band-Limited-White-Noise ground motion model coupled with Random Vibration Theory. A 16-station seismic attenuation and site response survey utilizing three-component portable digital seismographs was also performed for a five-month period in 1989. Based on the recordings of regional earthquakes, the effects of seismic attenuation in the shallow crust and along the propagation path and local site response were evaluated. This data combined with a detailed geologic profile developed for each site based principally on borehole data, was used in the estimation of the strong ground motion parameters. The preliminary peak horizontal ground accelerations for individual sites range from approximately 0.15 to 0.35 g. Based on our analysis, the thick sedimentary interbeds (greater than 20 m) in the basalt section attenuate ground motions as speculated upon in a number of previous studies. 26 refs., 6 figs.

3808 (EGG-M–89193) **Seismic design criteria at the Idaho National Engineering Laboratory (INEL).** Harris, B.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8910192–16: 2. DOE natural phenomena hazards mitigation conference, Knoxville, TN (USA), 3-5 Oct 1989). Order Number DE90002047. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

During the 40-year existence of the INEL site, the criteria used for the seismic design of facilities have evolved based on the increased understanding of earthquakes, their effect on structures, and the specific seismic characteristics of the INEL. Several studies, including one scheduled for completion this year, have been initiated since 1970 for the purpose of utilizing evolving technology to better define reasonable, yet conservative, seismic design criteria. 26 refs., 1 fig.

3809 (IC–89/50) **Thermal stress and seismogenesis.** Zhou Huilan; Wei Dongping. International Centre for Theoretical Physics, Trieste (Italy). May 1989. 19p. Order Number DE90608161. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper, the Fourier stress method was applied to deal with the problem of plane thermal stress, and a computing formula was given. As an example, we set up a variate temperature field to describe the uplifted upper mantle in Bozhong area of China, and the computing results shows that the maximum value of thermal plane shear stress is up to nearly $7x10^7$ P_α in two regions of this area. Since the Bohai earthquake (18 July, 1969, M_s = 7.4) occurred at the edge of one of them and Tangshan earthquake (28 July, 1976, M_s = 7.8) within another, their occurrences can be related reasonably to the thermal stress. (author). 15 refs, 7 figs.

3810 (IC–89/51) **Self-similar growth of three-dimensional fault.** Zhou Huilan. International Centre for Theoretical Physics, Trieste (Italy). Apr 1989. 13p. Order Number DE90608162. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

By using forthright mathematical treatment, this paper expands the two-dimensional Self-Similar model of faulting proposed by Fukao and Furumoto (1985) in three-dimensions, and explains the energy ratio of α of precursor to main shock, magnitude difference ΔMU between the main shock and its largest aftershock, and b value in magnitude-frequency relationship. The present model gives α 0.08, ΔMU = 1.21 and b = 1.5, respectively. These results are more consistent with the observations than the two-dimensional model. (author). 3 refs, 2 figs, 2 tabs.

3811 (LBL–26362) **Earth Sciences Division annual report 1988.** Lawrence Berkeley Lab., CA (USA). Aug 1989. 194p. Sponsored by U.S. Department of Defense; U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research; U.S. DOE Fossil Energy; U.S. DOE Radioactive Waste Management; U.S. Department of the Interior; Environmental Protection Agency; Gas Research Ins DOE Contract AC03-76SF00098. Order Number DE90002617. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Scientists and engineers of the Earth Sciences Division, following the mission of a multipurpose National Laboratory, conduct research on a wide variety of topics relevant to the nation's energy development programs. This report summarizes the activities for 1988. The Earth Sciences Division has developed unique expertise in several research areas. Much of the Division's research deals with the physical and chemical properties and processes in the earth's crust, from the partially saturated, low-temperature near-surface environment to the high-temperature environments characteristic of regions where magmatic-hydrothermal processes are active. Strengths in laboratory and field instrumentation, numerical modeling, and in situ measurement allow study of the transport of mass and heat through geologic media – studies that now include the appropriate chemical reactions and the hydraulic-mechanical complexities of fractured rock systems. Related and parallel laboratory and field investigations address the effects of temperature, pressure, stresses, pore fluids, and fractures on the elastic and electrical properties of rock masses. These studies are concerned with rock behavior in the brittle and ductile crustal regimes, and they drive the development of improved geomechanical and geophysical tools and techniques for mapping and characterizing heterogeneity in the subsurface.

3812 (LBL–27778) **VSP [Vertical Seismic Profiling] and cross hole tomographic imaging for fracture characterization.** Majer, E.L.; Peterson, J.E.; Myer, L.R.; Karasaki, K.; Daley, T.M.; Long, J.C.S. Lawrence Berkeley Lab., CA (USA). Sep 1989. 10p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (CONF-890928–13: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90002680. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

For the past several years LBL has been carrying out experiments at various fractured rock sites to determine the fundamental nature of the propagation of seismic waves in fractured media. These experiments have been utilizing high frequency (1000 to 10000 Hz.) signals in a cross-hole configuration at scales of several tens of meters. Three component sources and receivers are used to map fracture density, and orientation. The goal of the experiments has been to relate the seismological parameters to the hydrological parameters, if possible, in order to provide a more accurate description of a starting model for hydrological characterization. The work is ultimately aimed at the characterization and monitoring of the Yucca Mountain site for the storage of nuclear waste. In addition to these controlled experiments multicomponent VSP work has been carried out at several sites to determine fracture characteristics. The results to date indicate that both P-wave and S-wave can be used to map the location of fractures. In addition, fractures that are open and conductive are much more visible to seismic waves that nonconductive fractures. The results of these tests indicate direct use in an unsaturated environment. 12 refs., 10 figs.

3813 (NUREG/CR–5269) **Evaluation of hypotheses for the cause of the 1886 Charleston earthquake: Final report.** White, R.M.; Long, L.T. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Law Environmental, Inc., Kennesaw, GA (USA); Georgia Inst. of Tech., Atlanta, GA (USA). Oct 1989. 489p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A21/MF A01 - GPO; OSTI; INIS.

This report describes a geophysical/geological investigation of the earth's crust at seismogenic depths in the Charleston, South Carolina area. This investigation was made for the purpose of narrowing the range of theories that have been used to explain the historic 1886 Charleston earthquake. Since a number of these theories are based on only a portion of the available data, we have established a comprehensive data set in order to allow these hypotheses to be subjected to the entire data set. Specifically, we combined existing and new gravity, magnetic and topographic data in grids of 128 km, 256 km and 1028 km on a side centered on Charleston. Seismic, geologic and drilling data were collected and summarized. A magnetotelluric survey consisting of 12 soundings interpreted to depths of over 40 kilometers defined the bottom of the rigid crust with assistance from seismic reflection and other data. A geologic model of the crust in the area of Charleston was constructed and it defined the locations of Triassic/Jurassic basins Paleozoic plutons in greater detail than has previously been achieved. 102 refs., 75 figs.

3814 (NUREG/CR–5418) **Near-surface neotectonic deformation associated with seismicity in the northeastern United States.** Alexander, S.S.; Gold, D.P.; Gardner, T.W.; Slingerland, R.L.; Thornton, C.P. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pennsylvania State Univ., University Park, PA (USA). Dept. of Geosciences. Oct 1989. 313p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A14/MF A01 - GPO; OSTI; INIS.

For the Lancaster, PA seismic zone a multifaceted investigation revealed several manifestations of near-surface, neotectonic deformation. Remote sensing data together with surface geological and geophysical observations, and recent seismicity reveal that the neotectonic deformation is concentrated in a NS-trending fault zone some 50 km in length and 10–20 km in width. Anomalies associated with this zone include distinctive lineament and surface erosional patterns; geologically recent uplift evidenced by elevations of stream terraces along the Susquehanna River; and localized contemporary travertine deposits in streams down-drainage from the inferred active fault zone. In the Moodus seismic zone the frequency of tectonically-controlled lineaments was observed to increase in the Moodus quadrangle compared to adjacent areas and dominant lineament directions were observed that are perpendicular and parallel to the orientation of the maximum horizontal stress direction (N80-85E) recently determined from in-situ stress measurements in a 1.5 km-deep borehole in the seismic zone and from well-constrained earthquake focal mechanisms. 284 refs., 33 figs.

3815 (SAND–89-1508) **Seismic signal modeling of the RSTN and the NORESS/ARCESS data.** Hardin, T.L.; Breding, D.R. Sandia National Labs., Albuquerque, NM (USA). Sep 1989. 52p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90001798. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A Seismic Signal Modeling software package has been implemented for the RSTN and the NORESS/ARCESS data. The key features of the software are: (1) It removes over a limited band the gain and phase effects that were introduced by the seismometer and its associated filters. This removal was accomplished by using Finite Impulse Response (FIR) filter techniques to produce a resulting signal in terms of either ground-motion velocity or displacement. (2) It combines two separate bands of data, which are sampled at different rates, into a single broadband signal. (3) It produces a time-domain plot of the signals. (4) It produces a spectral analysis of the signals, including signal-to-noise ratio and comparison of the signals. 5 refs., 22 figs., 3 tabs.

5803 Mineralogy, Petrology, and Rock Mechanics

Refer also to citation(s) 3390, 3811

3816 (NUREG/CR–5429-Vol.2) **UDEC (Universal Distinct Element Code) version ICG1.5: User's manual: Volume 2.** Board, M. Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management; Itasca Consulting Group, Inc., Minneapolis, MN (USA). Sep 1989. 429p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A19/MF A01 - GPO - OSTI.

UDEC (Universal Distinct Element Code) is a two-dimensional distinct element program written for the static and dynamic analysis of the mechanical, thermal and hydrologic behavior of jointed rock masses. This program has been applied to a wide variety of problems in civil construction, mining, nuclear waste disposal, and geologic modeling. This document presents the theoretical basis for the mathematical models, the details of solution procedures, user's manual and presentation of verification and example problems. A description of the program support and documentation methodology which is employed is also given. This document is given in three volumes: Volume 1 – Description of Mathematical Models and Numerical Methods, Volume 2 – User's Manual, and Volume 3 – Verification and Example Problems. Three volumes are intended to satisfy the requirements and guidelines set forth in Final Technical Position and Documentation of Computer Codes for High-Level Waste Management (NUREG-0856). 28 refs., 108 figs., 10 tabs.

5804 Geochemistry

Refer also to citation(s) 3811

5805 Oceanography

3817 (DOE/ER/60555–3) **Transport and transfer rates in the waters of the continental shelf and slope: SEEP: Triennial report, 1 May 1987–30 April 1990.** Biscaye, P.E.; Anderson, R.F. Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory. Oct 1989. 56p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60555. Order Number DE90002970. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The SEEP Program was conceived in about 1980/1981 when most of the DOE-funded investigators in the Northeast decided to collaborate on a common experiment which was, for most, the next logical extension of their current research, but which was too large for any one or small subset to attempt on their own. Through a SEEP Executive Committee (consisting then of Walsh, Chairman; Biscaye, Csanady and Spencer), we proposed an experiment that had as its objective the quantitative determination of the fate of the fine-grained particulate material – both biogenic and abiogenic – observed in the waters of the continental shelf, but notably lacking in shelf sediments. Because most of the energy-related pollutants with which DOE is concerned become rapidly associated with fine-grained particles in the marine environment, a study of those particles and some pollutant proxies associated with them is, in effect, a study of the fate of pollutants. Specifically, it was posited that this fine material is transferred from the shelf to the slope waters by any of a number of mechanisms, and accumulated as part of the sediment on the continental slope. The SEEP Program was originally proposed in three successive phases in which experiments would be mounted first off New England and ending just north of Hatteras, with an intermediate experiment about mid-way between. The first experiment – SEEP-I, off New England – was carried out from 1983 to 1984, most of the papers from which were published in a special issue of Continental Shelf Research.

3818 (DOE/ER/60647–2) **Boundary processes in the nutrient-bearing stratum of the North Atlantic: Progress report, March 1, 1989–February 28, 1990.** Churchill, J.H.; Csanady, G.T. Old Dominion Univ., Norfolk, VA (USA). Research Foundation. Sep 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER60647. Order Number DE90002540. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Three parallel lines of work were initiated in the new three-year cycle of this grant which begun in March 1988. One deals with the role of the continental margins in the circulation and mass balance of the "nutrient bearing stratum" of the North Atlantic, another aims

at elucidating the physics of cross-shelf exchange processes, and the object of the third one is analysis and interpretation of observations taken in the SEEP I and II and MASAR experiments. The major effort of the PI was devoted to the role of the Gulf Stream in raising nutrient-rich upper thermocline fluid from the Sargasso Sea to a near-surface band on the shore-side of the Stream, and transporting it northeastward into the northern North Atlantic. The first accomplishment was a theoretical model quantifying "western boundary upwelling" and linking it to the energy dissipation occurring in such boundary currents as the Gulf Stream. Building upon the theoretical ideas, a calculation of nutrient transport by the Gulf Stream was undertaken at a succession of sections from the Florida Straits to the Grand Banks. The calculations were carried out by Jose Pelegri, a mature-age graduate student who joined the project in December 1988. First, the northeastward transport of nutrients by the Stream more than doubles between the Florida Straits and Cape Hatteras. This verifies the idea that the Stream collects a large inflow from the upper thermocline, the nutrient bearing stratum. Second, the core of the alongstream Reynolds flux (velocity times concentration) lies at a depth of only about 400 m. This again conforms to the notion that waters from the upper thermocline rise under the Stream and release their potential energy. Also, of course, they come into closer contact with the near surface layers. 6 refs.

3819 (PNL-SA–17111) **Current and suspended sediment measurements on the central California continental shelf.** Sherwood, C.R.; Coats, D.; Walls, B. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 7p. Sponsored by U.S. Department of Defense. DOE Contract AC06-76RL01830. (CONF-8909128–6: Oceans '89 conference, Seattle, WA (USA), 18-21 Sep 1989). Order Number DE90002676. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The US Army Corps of Engineers, San Francisco District (USACE), is evaluating the suitability of sites for ocean disposal of dredged material from several projects in the San Francisco Bay area. In conjunction with those efforts, the USACE maintained current meter moorings at two candidate disposal sites (Sites B1B and 1M) on the California continental shelf. Optical backscatterance (OBS) sensors mounted on these moorings near the sea bed were used to determine suspended sediment concentrations. The initial deployments at Site 1M (42 m) and Site B1B (86 m) occurred in April 1988; data were recovered in June and September 1988, and January 1989. Final instrument recovery was scheduled for May 1989, and the program should provide a full year of information on tidal and low-frequency shelf currents and near-bed suspended sediment concentrations. This is a preliminary report of the data from the 86-m site. The data showed evidence of strong vertical coherence in the currents, net southward flow at all depths during upwelling season, frequent flow reversals in fall and winter, and more frequent resuspension of sediment during the winter months. 9 refs., 5 figs., 2 tabs.

64 PHYSICS I

6401 Astrophysics and Cosmology

Refer also to citation(s) 3355, 3361, 3885, 3938, 3942, 3943, 3946, 3987, 4054, 4065, 4082, 4124, 4128, 4169, 4292

3820 (AD-A–210441/2/XAB) **Origin of the universe from Quantum Chaos: An introduction to current ideas (professor John Dyer Memorial Lecture). Technical report.** Woehler, K.E. Naval Postgraduate School, Monterey, CA (USA). May 1989. 45p. (NPS–61-89-010). Available from NTIS, PC A03/MF A01.

In his recently published book A Brief History of Time, S. Hawking describes his remarkable insights into the problem of the origin of our universe. In this talk a more quantitative description of some of the important principles from this book is presented as a mathematical appendix to it. A brief review of the ideas of the Standard Big Bang Model of the Universe is given in terms of the evolution equation that follows from Einstein's theory. The meaning of the Cosmological Constant, its relation to Vacuum Energy, the model of the empty DeSitter Space and Gravity is derived. By analogy to Schroedinger mechanics one can give the general features of Quantum Cosmology', in which the origin of the universe can be viewed as a quantum tunneling process in imaginary time from a Quantum Chaos state of no space, no time, no matter to an inflationary expanding DeSitter space which eventually transits into the Hot Big Bang Expansion that we see.

3821 (INIS-mf–12013, pp. 139) **The neutral gas-mass-spectrometer onboard the GIOTTO-probe to Comet Halley.** Krankowsky, D.; Laemmerzahl, P.; Woweries, J.; Stubbemann, U.; Anweiler, B. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Progress on the data analysis is briefly described. Work has concentrated on the refinement of coma expansion velocity and temperature results and on the study of the characteristics of the detector system from laboratory calibration data. A computer code has been developed for describing photochemical/ionchemical processes in a radially expanding coma. (orig.).

3822 (INIS-mf–12013, pp. 148) **Early phase of supernova remnant evolution.** Innes, D.; Tuffs, R. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Using one dimensional hydrodynamic computer simulations we calculate the interaction of supernova ejecta with a stellar wind bubble. (orig.).

3823 (INIS-mf–12013, pp. 148) **Acceleration of cosmic rays in SNR shock waves.** Drury, L.O'C.; Markiewicz, W.J.; Voelk, H.J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The time dependence of the energy density of cosmic rays accelerated in the outer shock of a supernova is studied in simple nonlinear models. The solutions are classified in their dependence on the parameters of the system. (orig.).

3824 (INIS-mf–12013, pp. 149) **Cosmic ray spectrum produced by supernova remnants with an upper limit on wave dissipation.** Voelk, H.J.; Zank, L.A.; Zank, G.P. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

By taking into account an upper limit to the wave dissipation we have shown that, within the limitations of test particle theory, supernova remnants (SNR) remain the prime candidates for the interstellar cosmic ray population below 10^{14} to 10^{15} eV/n. (orig.).

3825 (INIS-mf–12013, pp. 149) **Nonlinear waves in cosmic ray magnetohydrodynamics.** Zank, G.P. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The non-linear evolution and stability of waves arising in the two-fluid hydrodynamical model used to describe cosmic ray acceleration by the first-order Fermi process in astrophysical shocks has been studied in detail. In this way, we hope to capture some of the essential physics that applies in the fully non-linear case. (orig.).

3826 (INIS-mf–12013, pp. 150) **Stochastic acceleration of relativistic particles.** Carioli, S.M. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The relativistic formulation of the stochastic acceleration of a charge by means of an electric field wave packet in a magnetic field is given. The results are discussed in the framework of the problem of the acceleration of very high energy cosmic rays. (orig.).

3827 (INS–746) **Universe as a topological defect in a higher-dimensional Einstein-Yang-Mills theory.** Nakamura, A.; Shiraishi, K. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1989. 12p. Order Number DE90719507. Available from NTIS (US Sales Only), PC A03/MF A01.

An interpretation is suggested that a spontaneous compactification of space-time can be regarded as a topological defect in a higher-dimensional Einstein-Yang-Mills (EYM) theory. We start with D-dimensional EYM theory in our present analysis. A compactification leads to a D-2 dimensional effective action of Abelian gauge-Higgs theory. We find a 'vortex' solution in the effective theory. Our universe appears to be confined in a center of a 'vortex', which has D-4 large dimensions. In this paper we show an example with SU (2) symmetry in the original EYM theory, and the resulting solution is found to be equivalent to the 'instanton-induced compactification'. The cosmological implication is also mentioned. (author).

3828 (LBL–27747) **Supernovae, compact stars and nuclear physics.** Glendenning, N.K. Lawrence Berkeley Lab., CA (USA). 25 Aug 1989. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890826–6: International nuclear physics conference, Sao Paulo (Brazil), 20-26 Aug 1989). Order Number DE90002682. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We briefly review the current understanding of supernova. We investigate the implications of rapid rotation corresponding to the frequency of the new pulsar reported in the supernovae remnant SN1987A. It places very stringent conditions on the equation of state if the star is assumed to be bound by gravity alone. We find that the central energy density of the star must be greater than 12 times that of nuclear density to be stable against the most optimistic estimate of general relativistic instabilities. This is too high for the matter to plausibly consist of individual hadrons. We conclude that the newly discovered pulsar, if its half-millisecond signals are attributable to rotation, cannot be a neutron star. We show that it can be a strange quark star, and that the entire family of strange stars can sustain high rotation under appropriate conditions. We discuss the conversion of a neutron star to strange star, the possible existence of a crust of heavy ions held in suspension by centrifugal and electric forces, the cooling and other features. 39 refs., 8 figs., 2 tabs.

3829 (N–89-18288, pp. 65-66) **Isotopic and chemical evolution of planets: Mars as a missing link.** Depaolo, D.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

The study of planetary bodies has advanced to a stage where it is possible to contemplate general models for the chemical and physical evolution of planetary interiors, which might be referred to as UMPES (Unified Models of Planetary Evolution and Structure). UMPES would be able to predict the internal evolution and structure of a planet given certain input parameters such as mass, distance from the sun, and a time scale for accretion. Such models are highly dependent on natural observations because the basic material properties of planetary interiors, and the processes that take place during the evolution of planets are imperfectly understood. The idea of UMPES was particularly unrealistic when the only information available was from the earth. However, advances have been made in the understanding of the general aspects of planetary evolution now that there is geochemical and petrological data available for the moon and for meteorites.

3830 (N–89-18288, pp. 69-70) **Accretion and primary differentiation of Mars.** Drake, M.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

In collecting samples from Mars to address questions such as whether Mars accreted homogeneously or heterogeneously, how Mars segregated into a metallic core and silicate mantle, and whether Mars outgassed catastrophically coincident with accretion or more serenely on a longer timescale, we must be guided by our experience in addressing these questions for the Earth, Moon, and igneous meteorite parent bodies. A key measurement to be made on any sample returned from Mars is its oxygen isotopic composition. A single measurement will suffice to bind the SNC meteorites to Mars or demonstrate that they cannot be samples of that planet. A positive identification of Mars as the SNC parent planet will permit all that has been learned from the SNC meteorites to be applied to Mars with confidence. A negative result will perhaps be more exciting in forcing us to look for another object that has been geologically active in the recent past. If the oxygen isotopic composition of Earth and Mars are established to be distinct, accretion theory must provide for different compositions for two planets now separated by only 0.5 AU.

3831 (N–89-18288, pp. 73-74) **In situ chemical analyses of extraterrestrial bodies.** Economou, T.E.; Turkevich, A.L. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Abstract Only.

One of the most important tasks on any sample return mission will have to be a quick sample characterization in order to guarantee a variety of collected samples. An alpha particle instrument with alpha, proton and X-ray modes can provide a quick and almost complete chemical analysis of Mars samples. This instrument is based on three interactions of the alpha particles from a radioactive source with matter: elastic scattering of the alpha particles by nuclei (alpha mode), (alpha,p) nuclear reaction with some light elements (proton mode), and excitation of the atomic structure of atoms by alpha particles, leading to emission of characteristic X-rays of the lunar surface at three sites during the Surveyor mission of 1967 to 1968. Since then the instrument has been improved and miniaturized substantially. As shown in the past, the alpha particle instrument can operate under Martian conditions without any degradation in the performance. The alpha and proton modes can provide vital information about the light elements, while the X-ray mode with its ambient temperature X-ray detector will be useful for the heavier elements. The excitation of the atomic structure is provided by the same alpha radioactive source that is used by alpha and proton modes or by an auxiliary X-ray source that is selected to enhance the sensitivity to some important geochemical elements.

3832 (N–89-18288, pp. 75-76) **Cosmogenic nuclides in the Martian surface: constraints for sample recovery and transport.** Englert, P.A.J. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Stable and radioactive cosmogenic nuclides and radiation damage effects such as cosmic ray tracks can provide information on the surface history of Mars. A recent overview on developments in cosmogenic nuclide research for historical studies of predominantly extraterrestrial materials was published previously. The information content of cosmogenic nuclides and radiation damage effects produced in the Martian surface is based on the different ways of interaction of the primary galactic and solar cosmic radiation (GCR, SCR) and the secondary particle cascade. Generally the kind and extent of interactions as seen in the products depend on the following factors: (1) composition, energy and intensity of the primary SCR and GCR; (2) composition, energy and intensity of the GCR-induced cascade of secondary particles; (3) the target geometry, i.e., the spatial parameters of Martian surface features with respect to the primary radiation source; (4) the target chemistry, i.e., the chemical composition of the Martian surface at the sampling location down to the minor element level or lower; and (5) duration of the exposure. These factors are not independent of each other and have a major influence on sample taking strategies and techniques.

3833 (N–89-18288, pp. 88-89) **Martian weathering products as tracers of climate change and atmosphere/hydrosphere evolution on Mars.** Gooding, J.L. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science,

Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Primary objectives for exploration of Mars include determination of: (1) the distribution, abundance, and sources and sinks of volatile materials, and (2) the interaction of surface materials with the atmosphere. Both objectives fall within the purview of planetary surface weathering studies and require documented samples of weathered materials, including rock surfaces, soils, and sediments. Major issues to be addressed in selecting and studying Martian samples in this context are summarized.

3834 (N–89-18288, pp. 113-114) **Valles Marineris, Mars: an optimum science-sample site.** Lucchitta, B.K. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

The Valles Marineris troughs offer an opportunity to sample rocks that reflect various ages and compositions, giving insight into important processes on Mars. Most of the samples would be located within reasonable proximity and could be easily reached by rovers or balloons. Although landing a spacecraft on the floor of the Valles Marineris may be too dangerous for the first sample-return mission to Mars, the scientific rewards would be so great that such a landing should be considered for later flights.

3835 (N–89-18288, pp. 124-125) **Zeolites on Mars: Possible environmental indicators in soils and sediments.** Ming, D.W.; Gooding, J.L. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Weathering products should serve as indicators of weathering environments and may provide the best evidence of the nature of climate change on Mars. No direct mineralogical measurements of Martian regolith were performed by the Viking missions, but the biology and X-ray fluorescence experiments provided some information on the physiochemical properties of Martian regolith. Most post-Viking studies of candidate weathering products have emphasized phyllosilicates and Fe-oxides; zeolites are potentially important, but overlooked, candidate Martian minerals. Zeolites would be important on Mars for three different reasons. First, they are major sinks of atmospheric gases and, per unit mass, are stronger and more efficient sorbents than are phyllosilicates. Secondly, they can be virtually unique sorbents and shelters for organic compounds and possible catalysts for organic-based reactions. Finally, their exchangeable ions are good indicators of the chemical properties of solutions with which they have communicated. Accordingly, the search for information on past compositions of the Martian atmosphere and hydrosphere should find zeolites to be rich repositories.

3836 (N–89-18288, pp. 126-127) **What ferric oxide/oxyhydroxide phases are present on Mars.** Morris, R.V. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

The weathering history of Mars can be deduced largely from the mineralogy and distribution of ferric oxide/oxyhydroxide phases. As discussed, some insights can be gained through spectrophotometric remote sensing, but absolute determinations must depend on direct laboratory analysis of returned Martian samples.

3837 (N–89-18288, pp. 140) **Climate, atmosphere, and volatile inventory evolution: polar processes, climate records, volatile inventories.** Pollack, J.B. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Abstract Only.

Climate change on Mars was driven by long term changes in the solar luminosity, variations in the partitioning of volatiles between the atmosphere and near-surface reservoirs, and astronomical variations in axial and orbital properties. There are important parallels between these drives for Mars and comparable ones for Earth. In the early history of the solar system, the Sun's luminosity was 25 to 30 percent lower than its current value. It is suggested that an early benign climate on Earth was due to the presence of much more carbon dioxide in its atmosphere at these early times than currently resides there. Such a partitioning of carbon dioxide, at the expense of the carbonate rock reservoir, may have resulted from a more vigorous tectonic and volcanic style at early times. Such a line of reasoning may imply that much more carbon dioxide was present in the Martian atmosphere during the planet's early history than resides there today. It is now widely recognized that astronomical variations of the Earth's axial and orbital characteristics have played a dominant role in causing the succession of glacial and interglacial periods characterizing the last several million years. The magnitude of the axial and eccentricity variations are much larger for Mars than for Earth. Such changes on Mars could result in sizeable variations in atmospheric pressure, dust storm activity, and the stability of perennial carbon dioxide and water ice polar caps. These quasi-periodic climate changes occur on periods of 100,000 to 1,000,000 years and may be recorded in the sedimentary layers of the polar layered terrain.

3838 (N–89-18288, pp. 142) **Degassing history of Mars from Martian atmosphere samples.** Rao, A.S.P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Abstract Only.

A comparison of the abundances of Ar-40 and He-4 (radiogenic) in various terrestrial planetary atmospheres provides clues to the volcanic and tectonic histories of the planets while the amount of primordial noble gases in the planetary atmospheres provides clues to the quantities of volatile rich materials captured by each planet. The noble gas contents of Mars, Earth, and Venus clearly show that the absolute abundances of isotopes of gases are directly proportional to the amounts of degassed CO2 into the planetary atmosphere. Several basic geological units can be seen on the global geological map of Mars. The enormous size of volcanic and tectonic structures of Mars, despite its smaller size, provide invaluable clues to the degassing history of Mars. Therefore, the collection of samples of Martian atmosphere and soil volatiles is imperative to understand the origin and evolution of the atmosphere and its interaction with the Martian surface. Surface properties of Martian rocks, soils, breccias, and regolith and their chemistry are also generic to any discussion on the origin and evolution of the atmosphere of Mars. The differences in absolute abundances of gases in the planetary atmospheres are amenable to many alternative interpretations. These alternative interpretations can be tested by imposing additional constraints derived from the isotopic results of noble gases in the atmospheres of the planets.

3839 (N–89-18288, pp. 143-144) **Cosmogenic nuclides: Observable effects of Martian volatiles.** Reedy, R.C.; Drake, D.M.; Feldman, W.C. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Cosmic-ray produced (cosmogenic) nuclides in returned Martian samples could be used to study the amounts and distributions of volatiles in the recent past on Mars. In planning for the gamma-ray spectrometer experiment that is scheduled to fly on the Mars Observer, many calculations were done on the nuclear reactions that should occur in the Martian surface, studying especially the production and transport of neutrons. It is found that three aspects of Mars can very significantly affect the production of cosmogenic products in Mars: the Martian atmosphere and the presence of H2O in or CO2 on the surface of Mars. These volatile components can greatly affect the energy and spatial distributions of neutrons, expecially

those with thermal or near thermal energies, in the surface of Mars. In turn, these neutrons produce many cosmogenic nuclides that can be observed in samples returned from Mars.

3840 (N–89-18288, pp. 147-148) **Volcanic rocks and the geologic history of Mars.** Salpas, P.A. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

A number of questions exist regarding the geology of Mars which can be addressed by the proposed Mars rover-sample return mission. The use of a rover during the proposed mission greatly enhances the ability to investigate multiple aspects of Martian geology and geological history. Attempting to address all of the important questions may dilute the amount of information that can be obtained regarding each question and may result in no satisfactory answers. Prioritization is essential to a successful mission. The task of setting priorities is simplified somewhat when it is considered that answers to some of these questions do not require taking samples, and that for some questions, sample location is not as important as for others. The surface of Mars presents two distinct terrains, both of which have the potential to contain valuable information regarding the composition of Mars.

3841 (N–89-18288, pp. 149-150) **Role of impact cratering for Mars sample return.** Schultz, P.H. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

The preserved cratering record of Mars indicates that impacts play an important role in deciphering Martian geologic history, whether as a mechanism to modify the lithosphere and atmosphere or as a tool to sample the planet. The various roles of impact cratering in adding a broader understanding of Mars through returned samples are examined. Five broad roles include impact craters as: (1) a process in response to a different planetary localizer environment; (2) a probe for excavating crustal/mantle materials; (3) a possible localizer of magmatic and hydrothermal processes; (4) a chronicle of changes in the volcanic, sedimentary, atmospheric, and cosmic flux history; and (5) a chronometer for extending the geologic time scale to unsampled regions. The evidence for Earth-like processes and very nonlunar styles of volcanism and tectonism may shift the emphasis of a sampling strategy away from equally fundamental issues including crustal composition, unit ages, and climate history. Impact cratering not only played an important active role in the early Martian geologic history, it also provides an important tool for addressing such issues.

3842 (N–89-18288, pp. 163) **Experimental simulations of oxidizing conditions and organic decomposition on the surface of Mars.** Stoker, C.R.; Mancinelli, R.L.; Mckay, C.P. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Abstract Only.

One important scientific objective of a Mars Rover Sample Return mission would be to look for traces of living and extinct life on Mars. An instrument to search for organic carbon may be the simplest instrument that could screen samples which are interesting from a biological point of view. An experimental program is described which would help to understand the nature of the oxidizing soil on Mars and the mechanism responsible for organic degradation on the Martian surface. This is approached by lab simulations of the actual conditions that occur on Mars, particularly the oxidant production by atmospheric photochemistry, and the combined effects of UV light and oxidants in decomposing organic compounds. The results will be used to formulate models of the photochemistry of the atmospheric, the atmosphere-soil interaction, and the diffusion of reactive compounds into the soils. This information will provide insights and constraints on the design of a sampling strategy to search for organic compounds on Mars.

3843 (N–89-18288, pp. 164) **Noble gases as tracers of the origin and evolution of the Martian atmosphere and the degassing history of the planet.** Swindle, T.D. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Noble gas analysis of Martian samples can provide answers to a number of crucial questions. Some of the most obvious benefits will be in Martian chronology, using techniques that have been applied to lunar samples. However, these are by no means the only relevant noble gas studies possible. Since Mars has a substantial atmosphere, noble gases can be used to study the origin and evolution of that atmosphere, including the degassing history of the planet. This type of study can provide constraints on: (1) the total noble gas inventory of the planet, (2) the number of noble gas reservoirs existing, and (3) the exchange of gases between these reservoirs. How to achieve these goals are examined.

3844 (N–89-18288, pp. 166) **Examination of Martian sedimentary rocks to understand possible paleo-ocean and its age.** Tanaka, T. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Abstract Only.

It is well known that the terrestrial marine sediments have large cerium anomaly on their chondrite-normalized REE pattern. Siliceous shale and calcaleous sediments have negative Ce-anomaly. Ferromanganese nodule have positive or negative Ce-anomaly. The Ce-anomaly is considered to be a result of tetravalent state of cerium rather than common trivalent. Ferromanganese nodule which formed under reducing condition has negative Ce-anomaly. Then, combined study of Ce-anomaly with Ce isotopes is expected to play an important role in geochemistry. La-138 decays to Ce-138 and Ba-138 with a total half life of about 1 x 10 to the 11th years. Cerium anomalies (positive or negative) are expected in Martian paleo-ocean and in sediments as observed in the terrestrial environment. A list of things to be examined is given.

3845 (N–89-18288, pp. 167-168) **U-Th-Pb, Sm-Nd, Rb-Sr, and Lu-Hf systematics of returned Mars samples.** Tatsumoto, M.; Premo, W.R. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

The advantage of studying returned planetary samples cannot be overstated. A wider range of analytical techniques with higher sensitivities and accuracies can be applied to returned samples. Measurement of U-Th-Pb, Sm-Nd, Rb-Sr, and Lu-Hf isotopic systematics for chronology and isotopic tracer studies of planetary specimens cannot be done in situ with desirable precision. Returned Mars samples will be examined using all the physical, chemical, and geologic methods necessary to gain information on the origin and evolution of Mars. A returned Martian sample would provide ample information regarding the accretionary and evolutionary history of the Martian planetary body and possibly other planets of our solar system.

3846 (N–89-18288, pp. 171-172) **Crystal fractionation in the SNC meteorites: Implications for sample selection.** Treiman, A.H. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

Almost all rock types in the SNC meteorites are cumulates, products of magma differentiation by crystal fractionation (addition or removal of crystals). If the SNC meteorites are from the surface of

Mars or near subsurface, then most of the igneous units on Mars are differentiated. Basaltic units probably experienced minor to moderate differientation, but ultrabasic units probably experienced extreme differentiation. Products of this differentiation may include Fe-rich gabbro, pyroxenite, periodotite (and thus serpentine), and possibly massive sulfides. The SNC meteorites include ten lithologies (three in EETA79001), eight of which are crystal cumulates. The other lithologies, EETA79001 A and B are subophitic basalts.

3847 (N–89-18288, pp. 175-176) **Overview of Mars: SNC meteorite results.** Waenke, H. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

The SNC meteorites according to their oxygen isotope ratios and various trace element ratios form a distinct group of 8 achondrites. Their young crystallization ages and fractionated REE pattern which exclude an asteroidal origin, were the first observations to point towards Mars as their parent body. In spite of the many arguments for Mars as the parent body of the SNC meteorites there does not exist a generally accepted model for the ejecting process and other dynamical problems involved. In this discussion it is, however, assumed that Mars is the SNC parent body. The chemical composition of Mars is examined.

3848 (N–89-18288, pp. 179-180) **Stable isotopic studies of H,C,N,O and S in samples of Martian origin.** Wright, I. P.; Pillinger, C.T. Lunar and Planetary Inst., Houston, TX (USA). 1988. (NASA-CR–183337;NAS–1.26:183337;LPI-TR–88-07;CONF-8711303–: Workshop on Mars sample return science, Houston, TX (USA), 16 Nov 1987). In *Workshop on Mars Sample Return Science.* Available from NTIS, PC A09/MF A01.

The present day geochemical cycles of volatile elements through the various reservoirs on Earth are largely understood within the context of the planet's standing as a geologically and biologically evolved body. In terrestrial studies stable isotope measurements of light elements (H, C, N, O and S) can be utilized to obtain insight into the conditions prevailing during formation of rocks of various types. Perhaps the most important problem which could be addressed by light element studies of the sorts of specimen likely to be available from remote automatic sampling, would be the role of volatiles during evolution. Of fundamental importance here is the question of whether Mars was volatile rich or volatile poor. The only way to fully comprehend the effects of volatile cycling through the mantle crust and regolith atmosphere polar cap system of Mars, is by analyses of appropriate returned samples. In order to interpret the record of geological activity in Martian samples it will be necessary to understand how the past, or present, surface environment may have acted to disturb the primary characteristics of the rocks.

3849 (N–89-27608) **Cosmic evolution of non-topological solitons, paper 1.** Frieman, J.A.; Olinto, A.V.; Gleiser, M.; Alcock, C. Fermi National Accelerator Lab., Batavia, IL (USA). May 1989. 37p. (NASA-CR–185353;NAS–1.26:185353;FERMILAB-PUB–89/128-A-PAPER-1;NSF-ITP–89-87-PAPER-1). Available from NTIS, PC A03/MF A01.

Nontopological solitons are stable field configurations which may be formed in a primordial phase transition. Their cosmic evolution is studied, and the possibility that such objects could contribute significantly to the energy density of the Universe is examined. As the Universe cools, initially all but the largest lumps evaporate into free particles; those which survive may subsequently enter a brief accretion phase before they freeze out at a final size. Although the minimum critical charges which survive depend on particle masses and couplings, researchers develop an analysis which applies to a wide class of models. In most cases, solitons of moderate size survive the evaporation process only if there is a significant charge asymmetry or if they form at a temperature well below their binding energy per charge.

3850 (N–89-27629) **Statistical study of the correlation of hard X-ray and type 3 radio bursts in solar flares.** Hamilton, R.J.; Petrosian, V. Stanford Univ., CA (USA). May 1989. 39p. (NASA-CR–185833;NAS–1.26:185833;CSSA-ASTRO–89-03). Available from NTIS, PC A03/MF A01.

A large number of hard X-ray events which were recorded by the Hard X-Ray Burst Spectrometer (HXRBS) on the Solar Maximum Mission (SMM) during the maximum of the 21st solar cycle (circa 1980) are analyzed in order to study their statistical correlation with type 3 bursts. The earlier finding by Kane (1981) are confirmed qualitatively that flares with stronger hard X-ray emission, especially those with harder spectra, are more likely to produce a type 3 burst. The observed distribution of hard X-ray and type 3 events and their correlations are shown to be satisfactorily described by a bivariate distribution consistent with the assumption of statistical linear dependence of X-ray and radio burst intensities. From this analysis it was determined that the distribution of the ratio of X-ray intensity (in counts/s) to type 3 intensity (in solar flux units) which has a wide range and a typical value for this ratio of about 10. The implications of the results for impulsive phase models are discussed.

3851 (N–89-28454, pp. 3-13) **Toward a descriptive model of solar particles in the heliosphere.** Shea, M.A.; Smart, D.F.; Adams, J.H. Jr.; Chenette, D.; Feynman, J.; Hamilton, D.C.; Heckman, G.R.; Konradi, A.; Lee, M.A.; Nachtwey, D.S. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

During a workshop on the interplanetary charged particle environment held in 1987, a descriptive model of solar particles in the heliosphere was assembled. This model includes the fluence, composition, energy spectra, and spatial and temporal variations of solar particles both within and beyong 1 AU. The ability to predict solar particle fluences was also discussed. Suggestions for specific studies designed to improve the basic model were also made.

3852 (N–89-28454, pp. 14-32) **Toward a descriptive model of galactic cosmic rays in the heliosphere.** Mewaldt, R.A. (Chicago Univ., IL (USA)); Cummings, A.C.; Adams, J.H. Jr.; Evenson, P.; Fillius, W.; Jokipii, J.R.; Mckibben, R.B.; Robinson, P.A. Jr. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

Researchers review the elements that enter into phenomenological models of the composition, energy spectra, and the spatial and temporal variations of galactic cosmic rays, including the so-called anomalous cosmic ray component. Starting from an existing model, designed to describe the behavior of cosmic rays in the near-Earth environment, researchers suggest possible updates and improvements to this model, and then propose a quantitative approach for extending such a model into other regions of the heliosphere.

3853 (N–89-28454, pp. 49-56) **Current models of the intensely ionizing particle environment in space.** Adams, J.H. Jr. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

The Cosmic Ray Effects on MicroElectronics (CREME) model that is currently in use to estimate single event effect rates in spacecraft is described. The CREME model provides a description of the radiation environment in interplanetary space near the orbit of the earth that contains no major deficiencies. The accuracy of the galactic cosmic ray model is limited by the uncertainties in solar modulation. The model for solar energetic particles could be improved by making use of all the data that has been collected on solar energetic particle events. There remain major uncertainties about the environment within the earth's magnetosphere, because of the uncertainties over the charge states of the heavy ions in the anomalous component and solar flares, and because of trapped heavy ions. The present CREME model is valid only at 1 AU, but it could be extended to other parts of the heliosphere. There is considerable data on the radiation environment from 0.2 to 35 AU in the ecliptic plane. This data could be used to extend the CREME model.

3854 (N–89-28454, pp. 58-71) **A new proton fluence model for E greater than 10 MeV.** Feynman, J. (Boston Coll., Chestnut Hill, MA (USA)); Armstrong, T.P.; Dao-Gibner, L.; Silverman, S. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

Researchers describe a new engineering model for the fluence of protons with energies greater than 10 MeV. The data set used is a combination of observations made primarily from the Earth's surface between 1956 and 1963 and observations made from spacecraft in the vicinity of Earth between 1963 and 1985. With this data set we find that the distinction between ordinary proton events and anomalously large proton events made in earlier work disappears. The greater than 10 MeV fluences at 1 AU calculated with the new model are about twice those expected on the basis of models now in use. In contrast to earlier models, results do not depend critically on the fluence from any one event.

3855 (N–89-28454, pp. 75-84) **Intensity/time profiles of solar particle events at one astronomical unit.** Shea, M.A. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

A description of the intensity-time profiles of solar proton events observed at the orbit of the earth is presented. The discussion, which includes descriptive figures, presents a general overview of the subject without the detailed mathematical description of the physical processes which usually accompany most reviews.

3856 (N–89-28454, pp. 86-90) **The radial dependence of the solar energetic particle flux.** Hamilton, D.C. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

Researchers discuss the radial dependence of the peak flux and the fluence of solar flare produced energetic particles under the assumption that they propagate diffusively in the heliosphere.

3857 (N–89-28454, pp. 91-100) **Solar proton event forecasts.** Heckman, G.R. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

The United States operates a space weather service to provide information on space hazards including solar proton events to Federal government agencies and other users who operate systems that are affected by disturbances in the upper atmosphere and interplanetary environment. The observation and prediction of solar proton events has been continuous through solar cycle 21 (1976 to 1986), establishing a base of experience that can be used in providing similar support to space operations in the 1990's. The observations, indices, alerts, and forecasts used in the service are described. Also provided is a short summary of the experience obtained from making proton event predictions in solar cycle 21 including the years 1976 to 1986.

3858 (N–89-28454, pp. 101-110) **Predicting the arrival times of solar particles.** Smart, D.F. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

A procedure has been developed to generate a computerized time-intensity profile of the solar proton intensity expected at the earth after the occurrence of a significant solar flare on the sun. This procedure is a combination of many pieces of independent research and theoretical results. Many of the concepts used were first reported by Smart and Shea (1979) and are summarized by Smart and Shea (1985). Extracts from the general procedure that relate to predicting the expected onset time and time of maximum at the earth after the occurrence of a solar flare are presented.

3859 (N–89-28454, pp. 111-116) **Particles accelerated by shocks in the heliosphere.** Lee, M.A. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

The populations of energetic ions accelerated by shocks in the heliosphere are reviewed briefly. Characteristic spectra and representative fluxes are given.

3860 (N–89-28454, pp. 117) **High-energy particles very near the sun.** Goldstein, B.E. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

NASA's long range plans include a Solar Probe (Star Probe) mission in which a spacecraft is placed in an eccentric orbit with perihelion at four solar radii. As part of the study effort for this mission, a Solar Probe Environment Workshop was sponsored by JPL. The report of this committee was issued in September 1978 as JPL Publication 78-64. A brief abstract of this document is given. There are considerable uncertainties in the models of solar energetic particle release and transport. The committee addressed this problem by using different modelling techniques when possible to provide a cross-check on the estimates. These models were used to extrapolate observation at 1 AU to the vicinity of the Sun. Additionally, the occurrence of a flare of a given magnitude must be estimated on a statistical basis. Therefore, it is possible to state a likelihood that the fluxes and fluences will be less than a certain magnitude, but in the event of an extremely large solar flare (occurrence of perhaps once a decade, e.g., August 4, 1972) it is likely that the hazard would be insurmountable. A brief first look indicates that the near-solar particle environment is not a worse hazard than Jupiter.

3861 (N–89-28454, pp. 121-132) **Elemental composition and energy spectra of galactic cosmic rays.** Mewaldt, R.A. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

A brief review is presented of the major features of the elemental composition and energy spectra of galactic cosmic rays. The requirements for phenomenological models of cosmic ray composition and energy spectra are discussed, and possible improvements to an existing model are suggested.

3862 (N–89-28454, pp. 133-134) **The anomalous cosmic-ray component.** Cummings, A.C.; Stone, E.C. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

This brief report is intended to update the anomalous component section of the summary report of the galactic cosmic-ray working group (Mewaldt et al., 1987), which was drafted at the March 1987 Workshop on the Interplanetary Charged Particle Environment at the Jet Propulsion Laboratory. The description of the spectrum of the anomalous cosmic-ray component is contained in section 3.3 of that report. That description is based on data analyzed through day 310 of 1986, and in it we proposed that the energy spectrum of the various species of the anomalous component could be derived by scaling from two generic spectra. Two generic spectra were required because the energy spectrum of the anomalous component

changed shape near the time of the solar magnetic field reversal in 1980. These two generic spectra are shown in Figure 2 of the summary report.

3863 (N–89-28454, pp. 135-148) **Gradients of galactic cosmic rays and anomalous components.** McKibben, R.B. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

Measurements of radial and latitudinal gradients of galactic cosmic rays and anomalous components now cover radii from 0.3 to 40 AU from the sun and latitudes up to 30 deg above the ecliptic plane for particle energies from approx. 10 MeV/n up to relativistic energies. The most accurate measurements cover the period 1972 through 1987, which includes more than one full 11 year cycle of solar activity. Radial gradients for glactic cosmic rays of all energies and species are small (similar to less than 10 percent AU), and variable in time, reaching a minimum of near 0 percent AU out to 30 AU for some species at solar maximum. Gradients for anomalous components are larger, of order 15 percent AU, may show similar time variability, and are relatively independent of particle species and energy. For the period 1985 through 1986 the intensity decreased away from the ecliptic for all species and energies. For galactic cosmic rays, the measured gradients are approx. 0.5 percent/degree near 20 AU, while for anomalous components the gradients are larger, ranging from 3 to 6 percent/degree. Comparison with a similar measurement for anomalous helium in 1975 through 1976 suggests that the latitude gradients for anomalous components have changed sign between 1975 and 1985. For galactic cosmic rays, the available evidence suggests no change in sign of the latitudinal gradient for relativistic particles.

3864 (N–89-28454, pp. 149-161) **Time variation of galactic cosmic rays.** Evenson, P. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

Time variations in the flux of galactic cosmic rays are the result of changing conditions in the solar wind. Maximum cosmic ray fluxes, which occur when solar activity is at a minimum, are well defined. Reductions from this maximum level are typically systematic and predictable but on occasion are rapid and unexpected. Models relating the flux level at lower energy to that at neutron monitor energy are typically accurate to 20 percent of the total excursion at that energy. Other models, relating flux to observables such as sunspot number, flare frequency, and current sheet tilt are phenomenological but nevertheless can be quite accurate.

3865 (N–89-28454, pp. 162-163) **Galactic cosmic rays in three dimensions.** Jokipii, J.R. Jet Propulsion Lab., Pasadena, CA (USA). Apr 1988. (NASA-CR–185461;JPL-PUBL–88-28;NAS–1.26:185461;CONF-8703326–: Conference on interplanetary particle environment, Pasadena, CA (USA), 16-17 Mar 1987). In *Interplanetary particle environment. Proceedings of a conference.* Available from NTIS, PC A08/MF A01.

A general conclusion is that the cosmic rays increase with increasing distance from the Sun at approximately 2 percent a.u. There is a strong correlation of the cosmic ray intensity with distance with the tilt of the heliospheric current sheet. Moreover, researchers find that the variation of the cosmic rays with time changes in alternate sunspot cycles. Finally, it seems that during alternate sunspot minima (1965 and 1985) the cosmic rays access to the inner solar system was along the equatorial current sheet, wheras in 1975 the cosmic rays came in over the poles. The recently discovered anomalous component of cosmic rays is very much related to this whole problem, and probably corresponds to particles being accelerated at the termination of the solar wind at some 50 to 100 astonomical units from the sun. In summary, many predictions of the models remain controversial in detail. Nonetheless, it appears now that we can expect more cosmic rays over the poles in the next sunspot cycle, and the intensity will continue to increase with heliocentric radius out to the interstellar medium.

3866 (N–89-28471) **Silicon chemistry in interstellar clouds.** Langer, W.D.; Glassgold, A.E. Bell Telephone Labs., Inc., New York, NY (USA). May 1989. 32p. (NASA-CR–185862;NAS–1.26:185862). Available from NTIS, PC A03/MF A01.

Interstellar SiO was discovered shortly after CO but it has been detected mainly in high density and high temperature regions associated with outflow sources. A new model of interstellar silicon chemistry that explains the lack of SiO detections in cold clouds is presented which contains an exponential temperature dependence for the SiO abundance. A key aspect of the model is the sensitivity of SiO production by neutral silicon reactions to density and temperature, which arises from the dependence of the rate coefficients on the population of the excited fine structure levels of the silicon atom. This effect was originally pointed out in the context of neutral reactions of carbon and oxygen by Graff, who noted that the leading term in neutral atom-molecule interactions involves the quadrupole moment of the atom. Similar to the case of carbon, the requirement that Si has a quadrupole moment requires population of the J = 1 level, which lies 111K above the J = 0 ground state and has a critical density n(cr) equal to or greater than 10(6)/cu cm. The SiO abundance then has a temperature dependence proportional to exp(-111/T) and a quadratic density dependence for n less than n(cr). As part of the explanation of the lack of SiO detections at low temperatures and densities, this model also emphasizes the small efficiencies of the production routes and the correspondingly long times needed to reach equilibrium. Measurements of the abundance of SiO, in conjunction with theory, can provide information on the physical properties of interstellar clouds such as the abundances of oxygen bearing molecules and the depletion of interstellar silicon.

3867 (N–89-28474) **Time-variable phenomena in the Jovian system.** Belton, M.J.S.; West, R.A.; Rahe, J.; Pereyda, M. National Aeronautics and Space Administration, Washington, DC (USA). 1989. 406p. (NASA-SP–494;NAS–1.21:494;LC–88-25450;CONF-8708335–: International workshop on time-variable phenomena in the Jovian System, Flagstaff, AZ (USA), 25 Aug 1987). Available from NTIS, PC A18/MF A01.

Original contains color illustrations.

The current state of knowledge of dynamic processes in the Jovian system is assessed and summaries are provided of both theoretical and observational foundations upon which future research might be based. There are three sections: satellite phenomena and rings; magnetospheric phenomena, Io's torus, and aurorae; and atmospheric phenomena. Each chapter discusses time dependent theoretical framework for understanding and interpreting what is observed; others describe the evidence and nature of observed changes or their absence. A few chapters provide historical perspective and attempt to present a comprehensive synthesis of the current state of knowledge.

3868 (N–89-28476) **Coronagraph observations and analyses of the ultraviolet solar corona. Semiannual status report, 1 April 1987-31 March 1989.** Kohl, J.L. Smithsonian Institution, Cambridge, MA (USA). Smithsonian Astrophysical Observatory. Mar 1989. 20p. (NASA-CR–185830;NAS–1.26:185830;SASR–10;SASR–11;SASR–12;SASR–13). Available from NTIS, PC A03/MF A01.

The major activities on the Spartan Ultraviolet Coronal Spectrometer project include both scientific and experimental/technical efforts. In the scientific area, a detailed analysis of the previously reported Doppler dimming of HI Ly-alpha from the July 1982 rocket flight has determined an outflow velocity at 2 solar radii from sun center to be between 153 and 251 km/s at 67 percent confidence. The technical activities include, several improvements made to the instrument that will result in enhanced scientific performance or in regaining a capability that had deteriorated during the delay time in the launch date. These include testing and characterizing the detector for OVI radiation, characterizing a serrated occulter at UV and visible wavelengths, fabricating and testing telescope mirrors with improved edges, testing and evaluating a new array detector system, modifying the slit mask mechanism and installing a mask in the instrument to block the Ly-alpha resonance line when the electron scattered component is being observed.

3869 Pulsations of B stars: A review of observations and theories. . Cox, A.N. (Los Alamos National Lab., Los Alamos, NM (US)). pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). (CONF-8608130--: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

The author discusses the observational and theoretical status for several classes of variable B stars. The older classes now seem to be better understood in terms of those stars than probably have at least one radial mode and those that have only nonradial modes. The former are the δ CePhei variables, and the latter are the slowly rotating 53 Persei and the rapidly rotating zeta Ophiuchi variables. It seems that in this last class there are also some Be stars that show nonradial pulsations from the variations of the line shapes and their light. Among the nonradial pulsators, the author must also include the supergiants which show pulsations with very short lifetimes. A review of the present observational and theoretical problems is given. The most persistent problem of the cause for the pulsations is briefly discussed, and many proposed mechanisms plus some new thoughts are presented.

3870 The evolution of variable stars. Becker, S.A. (Los Alamos National Lab., Los Alamos, NM (US)). pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). DOE Contract W-7405-ENG-36. (CONF-8608130--: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

Throughout the domain of the H-R diagram lie groupings of stars whose luminosity varies with time. These variable stars can be classified based on their observed properties into distinct types such as β Cephei stars, δ Cephei stars, and Miras, as well as many other categories. The underlying mechanism for the variability is generally felt to be due to four different causes: geometric effects, rotation, eruptive process, and pulsation. In this review the focus is on pulsation variables and how the theory of stellar evolution can be used to explain how the various regions of variability on the H-R diagram are populated. To this end a generalized discussion of the evolutionary behavior of a massive star, an intermediate-mass star, and a low-mass star is presented.

3871 Linear nonadiabatic pulsations of homogeneous ZAMS stars. Cahn, J.H. (Dept. of Astronomy, Univ. of Illinois, Urbana, IL (US)); Cox, A.N.; Ostlie, D.A. pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). (CONF-8608130--: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

Current uncertainty about the most massive observed stars has led to reexamination of the most massive star that is stable against radial pulsation. The nuclear energy generation equations in the LNA linear, nonadiabatic code have been considerably improved, so that it is now appropriate to redo the study to determine the maximum mass of ZAMS star that will be stable against pulsation.

3872 Nonlinear RR Lyrae models with time dependent convection. Ostlie, D.A. (Dept. of Physics, Weber State College, Ogden, UT (US)); Cox, A.N. pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). (CONF-8608130--: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

Results of convective, nonlinear RR Lyrae models are presented. The standard mixing length theory has been used with time dependence being introduced through the convective velocity phase lag technique. Turbulent pressure and turbulent viscosity are also included. Results are compared with those of other time dependent convection theories.

3873 Nonlinear pulsations of luminous He stars. Proffitt, C.R. (Los Alamos National Lab., Los Alamos, NM (US)); Cox, A.N. pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). (CONF-8608130--: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

Radial pulsations in models of R Cor Bor stars and BD+$1^0$4381 have been studied with a nonlinear hydrodynamic pulsation code. Comparisons are made with previous calculations and with observed light and velocity curves.

3874 An asteroseismology explorer. Brown, T.M. (High Altitude Observatory/National Center for Atmospheric Research, Boulder, CO (US)); Cox, A.N. pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). (CONF-8608130--: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

In response to a NASA opportunity, a proposal has been made to study the concept of an Asteroseismology Explorer (ASE). The goal of the ASE would be to measure solar-like oscillations on many (perhaps hundreds) of stars during a 1-year mission, including many members of open clusters. In this paper, the authors describe this proposal's observational goals, a strawman technical approach, and likely scientific rewards.

3875 Hydrodynamic studies of oxygen, neon, and magnesium novae. Starrfield, S. (Dept. of Physics and Astronomy, Arizona State Univ., Tempe, AZ (US)); Sparks, W.M.; Truran, J.W. pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). (CONF-8608130--: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

In this paper the authors present the results of recent theoretical studies that have examined the properties of nova outbursts on ONeMg white dwarfs. These outbursts are much more violent and occur much more frequently then outbursts on CO white dwarfs. Hydrodynamic simulations of both kinds of outbursts are in excellent agreement with the observations.

3876 Inflation and non-equilibrium dynamics. Pi, S. (Physics Department, Boston University, Boston, Massachusetts 02215 (US)). *Annals of Physics (New York) (USA)*, 192(2): 421-431 (Jun 1989).

Herman Feshbach is a premier nuclear physicist. Although I do no research in his physics subfield, I have found it useful to apply methods developed in that area to early universe investigations that rely on a field-theoretic description for the time evolution of pure and/or mixed initial states. On the occasion of his seventieth birthday, I offer for his enjoyment this essay in which I describe how time-dependent Hartree–Fock methods and their generalizations to mixed states are used in attempts to establish various cosmological scenarios, in particular, inflation. © 1989 Academic Press, Inc.

3877 Testing the inverse-square law of gravity: Error and design with the upward continuation integral. Thomas, J. (Norman Bridge Laboratory of Physics, 161-33, California Institute of Technology, Pasadena, California 91125 (US)). *Physical Review [Section] D: Particles and Fields (USA)*, 40(6): 1735-1740 (15 Sep 1989).

It has been reported that the inverse-square law of gravity is violated over a range of a few hundred meters. I present a different method for the analysis of the data from that experiment. In this method, the experimental error can be evaluated analytically and I confirm the previous analysis but show that it is a 2σ effect. The method can also be used to design new experiments that will yield minimum errors for a fixed number of data points.

3878 Designing density fluctuation spectra in inflation. Salopek, D.S. (Department of Physics, University of Toronto, Toronto, Canada M5S 1A7 (CA)); Bond, J.R.; Bardeen, J.M. *Physical Review [Section] D: Particles and Fields (USA)*, 40(6): 1753-1788 (15 Sep 1989).

Scale-invariant (flat) fluctuation spectra are the most natural outcomes of inflation. Nonetheless current large-scale-structure observations seem to indicate more fluctuation power on large scales than flat spectra give. We consider a wide variety of models based on the chaotic inflation paradigm and sketch the effects that varying the expansion rate, structure of the potential surface, and the curvature coupling constants have on the quantum fluctuation spectra. We calculate in detail the quantum generation of fluctuation spectra by numerically solving the linearized perturbation equations for multiple scalar fields, the metric, and the radiation into which the scalars dissipate, following the evolution from inside the horizon through reheating.

3879 Bubble dynamics and spontaneous compactification. Blau, S.K. (Theoretical Division, T8, Mail Stop B-285, Los Alamos

National Laboratory, Los Alamos, New Mexico 87545 (US)); Guendelman, E.I. *Physical Review [Section] D: Particles and Fields (USA),* 40(6): 1909-1918 (15 Sep 1989).

As a laboratory for studying dimensional reduction in inhomogeneous spacetimes, we consider several five-dimensional models in which a bubble of a spacetime with a small compact dimension is sewn to a spacetime with all five dimensions macroscopic. Obliging the five-dimensional metric to be well behaved at the domain boundary constrains the parameters of the composite spacetimes under study. Given a suitable potential, it is possible that the domain wall is created by the rapid variation of the size of the compact dimension. Then it is appropriate to reduce the five-dimensional theory to an effective four-dimensional theory in which the size of the compact dimension plays the role of a scalar field. It is the effective four-dimensional metric which must be well defined at the domain boundary. We discuss several models of this latter type including some in which there is no singular contribution to the effective energy-momentum tensor even at the domain boundary.

3880 **Surface tension of strange-quark matter in the early Universe.** Berger, M.S. (Department of Physics, University of California, Berkeley, California 94720 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(6): 2128-2130 (15 Sep 1989). DOE Contract AC03-76SF00098.

The surface tension of strange-quark matter at finite temperature and pressure is calculated using the MIT bag model and is applied to strange-quark matter created in the QCD phase transition in the early Universe. The surface tension is sufficiently small that any strange-quark matter would have boiled away in the early Universe.

6402 Atmospheric Physics

Refer also to citation(s) 4362, 4367

3881 (AD-A–210337/2/XAB) **Space radiation environment at 840 km.** Mullen, E.G.; Gussenhoven, M.S.; Hardy, D.A. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1989. 16p. (GL-TR–89-0164). Available from NTIS, PC A03/MF A01.

The Defense Meteorological Satellite Program (DMSP) F7 satellite, launched in November 1983, carries a dosimeter provided by the Air Force Geophysics Laboratory. The dosimeter uses planar silicon detectors behind four thicknesses of aluminum shielding to measure both radiation dose and high-energy particle fluxes in the space-radiation environment at 840 km. Energy thresholds in the detectors are set to distinguish low (electron), high (proton), and very high (>40 MeV)-energy particle depositions. The dosimeter returns accurate, high-time-resolution dose measurements. Maps of the radiation dose (electron and proton) at 840 km are presented and compared to the NASA models. Maps of the very high-energy deposits which can produce Single Event Upsets (SEUs) in the microelectronic components are also presented. Characteristics of energetic particles that enter the polar-cap regions during solar-particle events are discussed and compared to inner-belt proton and cosmic-ray-background levels. Included is an analysis of two of the largest solar-proton events since launch of the satellite, those of 16 February, 1984, and 26 April, l984.

3882 (AD-A–210522/9/XAB) **Auroral energy deposition over the polar ionosphere during substorms. Technical report.** Ahn, B.; Kroehl, H.W.; Kamide, Y.; Gorney, D.J.; Akasofu, S. Aerospace Corp., El Segundo, CA (USA). Laboratory Operations. 15 Jun 1989. 44p. Available from NTIS, PC A03/MF A01.

The global Joule heating distributions are estimated through the magnetogram inversion method. This study employs instantaneous ionospheric conductance distributions deduced from the DMSP-F6 bremsstrahlung x-ray image data. Also estimated from the x-ray data are instantaneous global particle heating distributions. The two heating distributions thus obtained allow us to investigation of various aspects of heat energy processes over the polar ionosphere on an instantaneous basis. A special emphasis is placed on their spatial and temporal behaviors. Several important results of this study are summarized as follows: (1) Regions of significant Joule heating are closely associated with the auroral electrojets prominently in the dawn and dusk sectors. (2) The major Joule heating usually occurs poleward of the major particle-heating region, particularly in the morning sector. On the other hand, the two heating patterns are complementary in the longitudinal direction. (3) There is a higher correlation between the global Joule heating rate (U Sub J) and AE(12) than between the global particle heating rate (U Sub A) and AE(12). (4) The particle heating rate tends to be more prominent during the maximum phase of substorms and afterward than during the pre-expansion phase. (5) The U Sub J/U Sub A ratio varies by more than a factor of 10, suggesting the wide variability in the relative importance of the two heating rates. On the average, however, U Sub J is larger than U Sub A by a factor of 6.

3883 (AD-A–210791/0/XAB) **CRRES (Combined Release and Radiation Effects Satellite) SAPCERAD Plasma Wave Experiment. Final report, 20 April 1982-30 June 1988.** Anderson, R.R.; Gurnett, D.A. Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy. Oct 1988. 43p. Available from NTIS, PC A03/MF A01.

This document discusses the Main Electronics Package, two Electric Field Preamps and Search Coil Magnetometer. The AFGL 701 SPACERAD instrumentation on the CRRES (Combined Release and Radiation Effects Satellite) project. This document discusses the scientific objectives and the importance of the Plasma Wave Experiment in the CRRES SPACERAD mission and describes the instrument design rationale and the instrument development philosophy. The instrument description describes the instrument commands and their verifications. This document also discusses the testing and operations of the experiment and contains a schematic drawing of the instrumentation electronics and lists of the schematics, drawings, and wiring diagrams that describe the as-built configuration of the Plasma Wave Experiment instrumentation. Problems encountered during the construction and testing of the instrument and their resolutions are discussed. Test results from already completed environmental and EMC/RFI tests have already been submitted to AFGL and to the Air Force Headquarters Space Division Space Test Program. The recertification of the calibration of the instrument is recommended in the near future under a new contract covering the re-delivery (necessitated due to the removal during the launch-delay storage period), pre-launch, and launch operations.

3884 (AD-A–210792/8/XAB) **Optical instrumentation support for the airborne ionospheric observatory. Report for 1 July 1987-30 June 1988.** Eather, R.H.; Lance, C.A. Keo Consultants, Brookline, MA (USA). 1 Jul 1988. 36p. (KEO-ANNUAL–2). Available from NTIS, PC A03/MF A01.

The objectives were to participate in ionospheric research programs using the new optical equipment that was planned to be installed on the Airborne Ionospheric Observatory (AIO), a research aircraft operated by the Ionospheric Effects Branch at AFGL. This participation was to include: (a) testing, improvement, and continuing development of the software operating systems that control the instrument operation, (b) Complete testing, calibration, and documentation of all optical properties of the optical systems, (c) Improvements and continuing development of data recording systems for all instruments, and techniques for quick-look data presentation, (d) Assistance in analysis of optical data obtained on airglow and auroral experiments, and (e) Provide personnel assistance on research flights and field trips as required by AFGL.

3885 (AD-A–955597/0/XAB) **Solar diurnal variation in the amplitude of sudden commencements of magnetic storms at the geomagnetic equator.** Sugiura, M. Alaska Univ., Fairbanks, AK (USA). Geophysical Inst. Dec 1953. 4p. (UAG-CONTRIB-SER-A–12). Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 58, No. 4, 558-559(Dec 1953).

MAGNETIC STORMS/sudden commencements; SOLAR RADIATION; GEOMAGNETIC EQUATOR; AMPLITUDES

3886 **Propagation of a laser beam through self-induced turbulence.** Chitanvis, S.M. (Los Alamos National Laboratory, Theoretical Division, Los Alamos, New Mexico 87545 (US)). *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 490-492 (1 Oct 1988). (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

Using a model developed by us previously for thermal fluctuations induced in clean or aerosol/obscurant-loaded air by a high-energy laser beam, we compute the mutual coherence function of this high-energy laser beam as it propagates through self-induced turbulence. We use the plane wave approximation to the laser beam. Results are presented for the case of a CW beam with a flux level of $5 \times 10^3 W/cm^2$ propagating through air loaded with fog-oil droplets of total optical depths up to 2.5. The computed mutual coherence function indicates that propagation through induced turbulence in this case can affect the average size of a speckle spot considerably.

6403 Atomic, Molecular, and Chemical Physics

Refer also to citation(s) 2953, 3070, 3095, 3116, 3146, 3151, 3168, 3175, 3176, 3946, 4182, 4220, 4317, 4353

3887 (AD-A–210858/7/XAB) **Trajectory analysis of low-energy and hyperthermal ions scattered from Cu(110).** McEachern, R.L.; Goodstein, D.M.; Cooper, B.H. Cornell Univ., Ithaca, NY (USA). Lab. for Atomic and Solid State Physics. 15 May 1989. 13p. Available from NTIS, PC A03/MF A01.

Pub. in Physical Review B, Vol. 39, No. 15, 503-510(15 May 1989).

Trajectories of Na^+ ions scattered from the Cu(110) surface in the <1 1bar 0> and <001> azimuths were studied for a range of incident energies from 56 eV to 4 keV. The goal is to explain the trends observed in the energy spectra and determine what types of trajectories contribute to these spectra. Using the computer program SAFARI, simulations were performed with trajectory analyses for 100-, 200-, and 400-eV scattering. We show results from the 100-eV simulations in both azimuths and compare them with the experimental data. The simulated energy spectra are in excellent agreement with the data. Ion trajectories and impact parameter plots from the simulations are used to determine the relative importance of different types of ion-surface-atom collisions. The simulations have shown that the striking differences observed in comparing the <1 1bar 0> and <001> spectra are mostly due to ions which scatter from second-layer atoms. This system exhibits strong focusing onto the second-layer atoms by the first-layer rows, and the focusing is very sensitive to the spacing between the rows. At the lower beam energies, scattering from the second layer dominates the measured spectra.

3888 (IC–89/211) **QED based on self-energy: The relativistic $2S_{1/2}$ -> $1S_{1/2}+1\gamma$ decay rates of hydrogenlike atoms.** Barut, A.O.; Salamin, Y.I. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 8p. Order Number DE90607151. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Within the framework of the recently advanced formulation of QED based on self-energy, we calculate the relativistic rates of the $2S_{1/2}$ -> $1S_{1/2}+1\gamma$ transition in the hydrogen isoelectronic sequence for values of Z ranging between 1 and 92. We compare our results with those of Johnson (Phys. Rev. Lett. 29, 1123 (1972)) and Parpia and Johnson (Phys. Rev. A 26, 1142 (1982)) and find them to be in good agreement with both. (author). 12 refs, 1 tab.

3889 (INIS-mf–12013, pp. 107-108) **Laser-induced electron-ion interaction.** Baumann, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Welti, K.; Zwickler, S.; Berger, J.; Krause, P.; Neumann, R.; Schwalm, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

First experiments are in preparation, regarding laser-induced electron-ion recombination studies and laser-induced transfer of ions from Rydberg states to lower-lying levels. (orig.).

3890 (INIS-mf–12013, pp. 112) **Dielectronic recombination.** Baumann, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Welti, K.; Zwickler, S.; Berger, J.; Krause, P.; Neumann, R.; Schwalm, D.; Mueller, A.; Schuch, R. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The cross-sections for the dielectronic recombination of $C^{5+}+e^- -> C^{4+}$ have been calculated. (orig.).

3891 (LBL–27423) **Operational characteristics of a metal vapor vacuum arc ion source.** Shiraishi, Hiroshi; Brown, I.G. Lawrence Berkeley Lab., CA (USA). Jun 1989. 13p. Sponsored by U.S. Department of Defense. DOE Contract AC03-76SF00098. (CONF-890703–21: International conference on ion sources, Berkeley, CA (USA), 10-14 Jul 1989). Order Number DE90002453. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The MEVVA ion source can produce high current pulsed beams of metallic ions using a metal vapor vacuum arc discharge as the plasma medium from which the ions are extracted. In this study, the operational characteristics of the MEVVA IV ion source are summarized. Results are presented of measurements of the ion beam current as a function of arc current over a range of extraction voltage. Ti, Ta and Pb were examined as the cathode materials. The arc current ranged from 50A to 250A and the extraction voltage from 10kV to 80kV. The ion beam current was measured at two different distances from the ion source using Faraday cups, so as to investigate the beam divergence. Additionally, the cathode erosion rates were measured. Optimum operating conditions of the MEVVA ion source were determined. 10 refs., 6 figs.

3892 (NAL-TR–962) **Spectral characteristics of arc-heated low density plasma flows (3). Helium plasma.** Watanabe, Yasuo; Hirabayashi, Noriaki. National Aerospace Lab., Chofu, Tokyo (Japan). Feb 1988. 17p. (In Japanese). Order Number DE88757171. Available from NTIS (US Sales Only), PC A03/MF A01.

The spectral characteristics of helium plasma were examined in an arc-heated low density wind tunnel. HeI lines in the plenum chamber showed large broadening and the profiles of 492.2 (2^1P-4^1D) and 447.1 (2^3P-4^3D) nm lines were recorded and compared with theoretical profiles of Barnard to yield electron densities. Electron densities were also estimated by the Inglis-Teller relation from the determination of merging quantum number of 2^3P-n^3D series lines. These results were by several orders of magnitude larger than the values expected on the measured kinetic temperature and suggest large deviations from local thermodynamic equilibrium state in the plenum chamber. Oxygen was added to the flow and the resulting spectra were indentified as several OI lines and O_2^+ first negative system which were results from interactions with the helium flow. It was suggested that the use of these OI lines might be helpful in flow characterization and surface chemistry studies in a simulation facility for atomic oxygen interactions with spacecraft surfaces in low earth orbit. (17 figs, 1 tab, 18 refs)

3893 (RAL–89-070) **Light kaonic and antiprotonic atoms.** Batty, C.J. Rutherford Appleton Lab., Chilton (UK). Jul 1989. 12p. Sponsored by U.K. Science and Engineering Research Council. (CONF-8907127–4: 12. few body conference: few body problems in physics, Vancouver (Canada), 2-8 Jul 1989). Order Number DE90000520. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

Recent progress in the study of light kaonic and antiprotonic atoms is reviewed. Results for $\bar{p}$-He atoms are in good agreement with Optical Model calculations in contrast to the situation for K^--He atoms, the latter possibly indicating the existence of a kaon-nucleus bound state. The extensive results for $\bar{p}$-p atoms now available are generally in accord with theoretical expectations. Early results for K^--p atoms showed significant discrepancies and there is an urgent need for further experiments. 33 refs., 3 figs.

3894 (SAND–89-1685) **Physics guide to CEPXS: A multigroup coupled electron-photon cross-section generating code: Version 1.0.** Lorence, L.J. Jr.; Morel, J.E.; Valdez, G.D. Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 108p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE90002804. Available from NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

CEPXS is a multigroup-Legendre cross-section generating code. The multigroup-Legendre cross sections produced by CEPXS enable coupled electron-photon transport calculations to be performed with the one-dimensional discrete ordinates code, ONEDANT. We recommend that the 1989 version of ONEDANT that contains

linear-discontinuous spatial differencing and S2 synthetic acceleration be used for such calculations. CEPXS/ONEDANT effectively solves the Boltzmann-CSD transport equation for electrons and the Boltzmann transport equation for photons over the energy range from 100 MeV to 1.0 keV. The continuous slowing-down approximation is used for those electron interactions that result in small-energy losses. The extended transport correction is applied to the forward-peaked elastic scattering cross section for electrons. A standard multigroup-Legendre treatment is used for the other coupled electron-photon cross sections. CEPXS extracts electron cross-section information from the DATAPAC data set and photon cross-section information from Biggs-Lighthill data. The model that is used for ionization/relaxation in CEPXS is essentially the same as that employed in ITS. 43 refs., 8 figs.

3895 (SAND–89-2668C) **RADLAC-II propagation experiments.** Leifeste, G.T.; Crist, C.E. Sandia National Labs., Albuquerque, NM (USA). [1989]. 4p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8909216–9: DARPA/SDIO service annual charged particle beam review, Monterey, CA (USA), 18-21 Sep 1989). Order Number DE90002531. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In previous RADLAC-II beam propagation experiments, stable propagation over a Nordsieck length, in full pressure Albuquerque air (p ~640 Torr) was observed. In these experiments, high transverse momentum resulted in a large equilibrium radius and thus a long betatron wavelength. Following the completion of the RADLAC-II upgrade, a new set of experiments with a small diameter (d ~2 cm), high current (I ~40 kA), low transverse momentum ($\beta\perp$ ~0.2) should be possible. The development of time-resolved diagnostics, data analysis codes, and the formulation of output from theoretical calculations in a format as seen by these diagnostics in the lab continues to be a major source of effort in the program. 2 figs.

3896 (UCRL–21256) **Relativistic cross sections for excitation of highly charged ions to specific magnetic sublevels by an electron beam.** Zhang, Hong Lin; Sampson, D.H.; Clark, R.E.H. Lawrence Livermore National Lab., CA (USA). [1989]. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90002815. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A program has been developed for making calculations of fully relativistic distorted wave cross sections for excitation of highly charged ions to specific magnetic sublevels M_f by a beam of electrons. The approach uses the same Dirac-Fock-Slater potential for all electrons and is expected to be accurate for nuclear charge number $Z \gtrsim 2.5N$, where N is the number of bound electrons per ion. To our knowledge there is presently no other fully relativistic program available with which we could compare results for this type of cross sections. however, the present results for He-like, Li-like and Ne-like iron and for Ne-like molybdenum are compared with other partially relativistic results and generally good agreement is obtained for these ions. It is expected that the present program will be useful for comparison with and interpretation of experimental results for very lightly charged ions, such as obtained in EBIT experiments at Livermore. 23 refs., 4 tabs.

3897 (UCRL–21257) **Relativistic distorted wave collision strengths and oscillator strengths for the 85 Li-like ions with 8 $\leq$ Z $\leq$ 92.** Zhang, Hong Lin; Sampson, D.H.; Fontes, C.J. Lawrence Livermore National Lab., CA (USA); Pennsylvania State Univ., University Park, PA (USA). Dept. of Astronomy. [1989]. 51p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48;FG02-85ER53208. Order Number DE90002824. Available from NTIS, PC A04/MF A01 - OSTI.

Relativistic distorted wave collision strengths are given for the 3 transitions among the $2s_{1/2}$, $2p_{1/2}$ and $2p_{3/2}$ levels and for the 63 transitions from these levels to the excited levels nlj with n = 3, 4 and 5 in the 85 Li-like ions with nuclear charge number Z in the range 8 $\leq$ Z $\leq$ 92. The calculations were made for the six final, or scattered, electron energies $E' = 0.008, 0.004, 0.10, 0.21, 0.41$, and 0.75, where E′ is in units Z_{eff}^2 Rydbergs with $Z_{eff} = Z - 1.66$. In addition, the transition energies and electric dipole oscillator strengths are given. To our knowledge the present work is the first comprehensive publication of the results of fully relativistic calculations of the collision strengths for excitation of Li-like ions. 13 refs., 3 tabs.

3898 (UCRL–101247-Pts.1-2) **Investigation of an electron beam evaporative source: Part 1, Theory; Part 2, Measurements.** Sze, J.S.; Self, S.A. Lawrence Livermore National Lab., CA (USA). 14 Sep 1989. 37p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910187–1: 6. annual conference on electron beam melting and refining: state of the art, Reno, NV (USA), 29-31 Oct 1989). Order Number DE90003025. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A theory for evaluating the performance parameters of linear electron beam evaporative source is presented. The electron beam is considered to be generated from a linear gun and its trajectory is curved by a uniform magnetic field onto a target. A model has been developed to estimate the trajectory of the electron beam. The performance of the electron gun is characterized by two coefficients: α, the divergence effect of the beam as it enters into the electric field free space region, and B, the space charge parameter, which is proportional to the magnitude of the current density of the beam. These two parameters determine the location (angular position) of the beam waist and the current density at the target. In addition, neutralization of the electron space charge by vapor ions generated near the target is considered. A discussion is also given of the shape of the depression in the surface of the molten metal, which is due to the pressure on the surface associated with the momentum recoil from the evaporative vapor flux. By relating the characteristic depth and width of the depression to magnitude and the shape of the pressure profile, useful analytical and numerical results are presented for a given pressure profile. The implication of the results for the design of electron beam evaporative sources are also discussed. Measurements are discussed a the end of the paper. 11 refs., 15 figs.

3899 **A review of radiative and dielectronic recombination for C and O ions.** Griffin, D.C. (Rollins Coll., Winter Park, FL (USA). Dept. of Physics). *Physica Scripta (Sweden),* 28: 28 (1989). DOE Contract AC05-84OR21400. (CONF-8805213–: IAEA specialists' meeting on carbon and oxygen collision data for fusion plasma research, Vienna (Austria), 12-13 May 1988).

Theoretical calculations of radiative and dielectronic recombination rate coefficients for carbon and oxygen ions are reviewed. For radiative recombination into excited states, various hydrogenic formulae for recombination are considered, and results for total rates obtained by using explicit calculations of photoionization cross sections from the ground states of these ions in conjunction with such hydrogenic formulae are reported. For dielectronic recombination, the isolated-resonance approximation for the calculation of cross sections and rates is discussed, and rate coefficients for several carbon and oxygen ions are presented. The effects of electric fields and electron density on dielectronic recombination rates are considered. (orig.).

3900 **A new nonlinear-optical perturbation expansion and diagrammatic approach.** Trebino, R. (Combustion Research Facility, Sandia National Laboratories, Livermore, California 94550 (US)). *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 275-279 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

A new nonlinear-optical perturbation expansion and diagrammatic approach are derived yielding expressions for higher-order dephasing-induced phenomena.

3901 **Dephasing-induced coherences: higher-order selection rules and experiments in a magnetic field.** Rahn, L.A. (Combustion Research Facility, Sandia National Laboratories, Livermore, California 94550 (US)); Trebino, R. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 272-274 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

We observe dephasing-induced third-and higher-order wave-mixing spectra of Zeeman and hyperfine coherences in a sodium-seeded flame in a magnetic field. As the perturbation parameter approaches unity, we compare our experimental spectra with theoretical higher-order selection rules.

3902 The Autler-Townes effect in hydrogen at low pressure. Lau, A.M.F. (Combustion Research Facility, Sandia National Laboratories, Livermore, CA 94550 (US)). *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 323-325 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

The Autler-Townes effect (also known as ac, optical or dynamical Stark splitting) on the Balmer-α transition of hydrogen in 0.5–5 torr of helium is investigated. In the double optical resonance scheme, H(3p) is excited by absorption of two 243-nm photons and a 656-nm photon via the 2s resonant intermediate level. Calculated results show that in a Doppler-free or a "Doppler-reduced" beam configuration, the required intensity of the 656 nm laser (0.2 cm^{-1}bandwidth) for observing the Autler-Townes doublet has to be greater than 2×10^4 W/cm^2 and 2×10^5 W/cm^2 for a 243-nm laser bandwidth of 0.1 cm^{-1} and 0.5 cm^{-1}, respectively.

3903 High-order multiphoton ionization photoelectron spectroscopy of NO. Carman, H.S. Jr. (Chemical Physics Section, Oak Ridge National Laboratory P.O. Box X, Oak Ridge, Tennessee 37831-6125 (US)); Compton, R.N. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 334-336 (1 Oct 1988). DOE Contract AC05-84OR21400. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

Photoelectron energy and angular distributions of NO following three different high-order multiphoton ionization (MPI) schemes have been measured. The 3+3 resonantly enhanced multiphoton ionization (REMPI) via the $A^2\Sigma^+$ (v=0) level yielded a distribution of electron energies corresponding to all accessible vibrational levels (v^+=0–6) of the nascent ion. Angular distributions of electrons corresponding to v^+=0 and v^+=3 were significantly different. The 3+2 REMPI via the $A^2\Sigma^+$ (v=1) level produced only one low-energy electron peak (v^+=1). Nonresonant MPI at 532 nm yielded a distribution of electron energies corresponding to both four- and five-photon ionization. Prominent peaks in the five-photon photoelectron spectrum (PES) suggest contributions from near-resonant states at the three-photon level.

3904 Energy transfer studies with lasers. Weston, R.E. Jr. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973 (US)). *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 622-627 (1 Oct 1988). Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

Using pulsed lasers to produce energetic species, we have observed their interaction with other molecules in real time by absorption spectroscopy with a cw infrared diode laser. This technique has been used to observe the vibrational excitation of carbon dioxide by energy transfer from azulene and azulene-d_8 excited to energies of 30,000 and 40,000 cm^{-1}, and the relative populations of the bending and antisymmetric stretching modes of CO_2 are found to be very nonstatistical. Diode laser spectroscopy of CO has also been utilized to determine the efficiency of energy transfer from $O(^1D)$ atoms to vibrations of CO excited to v=1 through 4.

3905 Very high resolution saturation spectroscopy of lutetium isotopes via cw single-frequency laser resonance ionization mass spectrometry. Fearey, B.L. (Isotope and Nuclear Chemistry Group INC-7, Chemical and Laser Sciences Group CLS-2, Los Alamos National Laboratory, Los Alamos, NM 87545 (US)); Parent, D.C.; Keller, R.A.; Miller, C.M. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 776-778 (1 Oct 1988). DOE Contract W-7405-ENG-36. (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

In this paper, we discuss the use of Resonance Ionization Mass Spectrometry (RIMS) to perform isotopically selective saturation spectroscopy of lutetium isotopes. Utilizing this technique, it is shown that accurate measurements of the relative frequencies of hyperfine (HF) components for different isotopes easily can be made without the need for an isotopically enriched sample. The precision with which the HF splitting constants can be determined is estimated to be ~5 times greater than in previous work.

3906 Image-projection ion-beam lithography. Miller, P.A. (Surface Processing Sciences Division-1126, Sandia National Laboratories, Box 5800, Albuquerque, New Mexico 87185 (US)). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena (USA),* 7(5): 1053-1063 (Sep 1989). DOE Contract AC04-76DP00789.

Image-projection ion-beam lithography is an attractive alternative for submicron patterning because it may provide high throughput; it uses demagnification to gain advantages in reticle fabrication, inspection, and lifetime; and it enjoys the precise deposition characteristics of ions which cause essentially no collateral damage. This lithographic option involves extracting low-mass ions (e.g., He^+) from a plasma source, transmitting the ions at low voltage through a stencil reticle, and then accelerating and focusing the ions electrostatically onto a resist-coated wafer. While the advantages of this technology have been demonstrated experimentally by the work of IMS (Austria), many difficulties still impede extension of the technology to the high-volume production of microelectronic devices. We report a computational study of a lithography system designed to address problem areas in field size, telecentricity, and chromatic and geometric aberration. We present a novel ion-column-design approach and conceptual ion-source and column designs which address these issues. We find that image-projection ion-beam technology should in principle meet high-volume-production requirements. The technical success of our present relatively compact-column design requires that a glow-discharge-based ion source (or equivalent cold source) be developed and that moderate further improvement in geometric aberration levels be obtained. Our system requires that image predistortion be employed during reticle fabrication to overcome distortion due to residual image nonlinearity and space-charge forces. This constitutes a software data preparation step, as do correcting for distortions in electron lithography columns and performing proximity-effect corrections. Areas needing further fundamental work are identified.

3907 Direct and resonance contributions to electron-impact excitation of n=2 to n=3 transitions in neonlike ions. Chen, M.H. (High Temperature Physics Division, Lawrence Livermore National Laboratory, Livermore, California 94550 (US)); Reed, K.J. *Physical Review [Section] A: General Physics (USA),* 40(5): 2292-2300 (1 Sep 1989). DOE Contract W-7405-ENG-48.

Rate coefficients for electron-impact excitation have been calculated for transitions from the ground state to n=3 excited states of six neonlike ions with atomic numbers Z=15, 17, 26, 34, 42, and 54. The direct-excitation rate coefficients were calculated using relativistic multiconfiguration target wave functions and a relativistic distorted-wave approximation. The contributions from autoionizing resonances were evaluated using a multiconfiguration Dirac-Fock model. These resonances enhance the rate coefficients for transitions to the $2p^53s$ states by as much as a factor of 3. The peak rate coefficient and the relative importance of resonance excitation diminish with increasing atomic number. However, we find that resonance enhancements are generally quite large for electron temperatures less than the temperature where peak excitation occurs. Our total rate coefficients for Se^{24+} are in good agreement with close-coupling results obtained with R-matrix calculations. The resonance contributions from the present work differ from the results by Smith *et al.* [Astrophys. J. 298, 898 (1985)] for the Fe^{16+} ion by as much as a factor of 3–5.

3908 Electron degradation and yields of initial products. VI. Energy spectra of subexcitation electrons in argon and molecular hydrogen. Kimura, M. (Argonne National Laboratory, Argonne, Illinois 60439 (US)); Inokuti, M.; Kowari, K. *Physical Review [Section] A: General Physics (USA),* 40(5): 2316-2320 (1 Sep 1989). DOE Contract W-31-109-ENG-38.

Energy spectra of subexcitation electrons for Ar and H_2 are studied by using rigorous theory based on the Spencer-Fano equation. The origins of the structure in the energy spectrum and the differences between the two spectra are discussed.

3909 Superelastic scattering of spin-polarized electrons from sodium. McClelland, J.J. (National Institute of Standards and Technology, Gaithersburg, Maryland 20899 (US)); Kelley, M.H.; Celotta, R.J. *Physical Review [Section] A: General Physics (USA),* 40(5): 2321-2329 (1 Sep 1989).

Superelastic scattering of spin-polarized electrons from laser-excited sodium atoms has been measured at incident energies of 2.0, 17.9, and 52.3 eV over the angular range 10°–120°. Circularly polarized excitation of the sodium atoms was used to produce pure $3\,^2P_{3/2}$ (F=3, M_F=±3) states, which are deexcited by collisions with spin-polarized electrons. The spin polarization of both the target electron and the incident electron allows the resolution of triplet and singlet contributions to $L_\perp$, the angular momentum transferred in the collision perpendicular to the scattering plane, and the measurement of r, the ratio of triplet to singlet cross sections. At low energy, agreement with theory is good over the entire angular range for r, but only at small angles for $L_\perp$. At high energy, agreement is excellent over the full angular range.

3910 Comparison of single-electron removal processes in collisions of electrons, positrons, protons, and antiprotons with hydrogen and helium. Schultz, D.R. (Department of Physics and Laboratory for Atomic and Molecular Research, University of Missouri-Rolla, Rolla, Missouri 65401 (US))). *Physical Review [Section] A: General Physics (USA),* 40(5): 2330-2334 (1 Sep 1989).

We present and compare total cross sections for single-electron removal in collisions of electrons, positrons, protons, and antiprotons with atomic hydrogen and helium. These cross sections have been calculated using the classical trajectory Monte Carlo technique in the velocity range of 0.5–7.0 a.u. (6.25–1224 keV/u). The cross sections are compared at equal collision velocities and exhibit differences arising from variations in mass and sign of charge of the projectile. At low and intermediate velocities these differences are large in both the ionization and charge transfer channels. At high velocities the single-ionization cross section for each of these singly charged particles becomes equal. However, the differences in the single-charge-transfer cross sections for positron and proton impact persist to very large velocities. We extend our previous work [Phys. Rev. A 38, 1866 (1988)] to explain these mass and sign of the charge effects in single-electron removal collisions.

3911 Effects of relativity and configuration interaction on *L*-shell Auger and radiative decays of the doubly excited $3l3l'$ states of sodiumlike ions. Chen, M.H. (High Temperature Physics Division, Lawrence Livermore National Laboratory, Livermore, California 94550 (US)). *Physical Review [Section] A: General Physics (USA),* 40(5): 2365-2372 (1 Sep 1989). DOE Contract W-7405-ENG-48.

Auger and radiative transition energies and rates for the states from the $2p^5 3l3l'$ and $2s2p^6 3l3l'$ configurations of the Na-like ions have been calculated for 18 ions with atomic number $18 \le Z \le 92$ using the multiconfiguration Dirac-Fock method. The Z dependence of the transition rates for a few selected states has been analyzed. Numerous irregularities are present in many transitions due to the level-crossing interaction. The effects of relativity and configuration interaction are simultaneously important for medium and heavy ions. These effects can sometimes change the rates for weak transitions by orders of magnitude. Strong configuration interaction between states from the $2p^5 3p^2$ and $2p^5 3s3d$ configurations has been found. Inclusion of the Breit interaction in calculations of the Auger matrix elements can change the Auger rates by as much as a factor of 2. The spin-orbit mixing and Breit interaction are responsible for the decay of most of the quartet states. In particular, the $2p^5 3s3p^4 D_{7/2}$ metastable state of low-Z ions decays predominantly by Auger-electron emission via the magnetic interaction.

3912 One-dimensional model for photodetachment in a static electric field. Peek, J.M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)). *Physical Review [Section] A: General Physics (USA),* 40(5): 2393-2399 (1 Sep 1989).

The photodetachment of a particle bound in a one-dimensional square well and subject to a static electric field is considered. This cross section is shown to have a rich structure that can be analyzed in relatively simple terms. The appearance of regularly spaced zeros in the cross section, as a function of photon energy, is one such feature. The spacing of the intervening peaks is either identical to or similar to that found in other studies. The peak asymmetry, the oscillatory amplitude, and another type of zero in the oscillator strength, which are related to the target's binding potential, are properties of this model not found in other studies. A connecting formula between the finite- and zero-field oscillator strengths is derived and found to be useful for field strengths between zero and that for which tunneling from the initial state becomes a competing mechanism for ionization. An approximate final-state function provides a particularly simple relationship between the two cases and it displays a part of the structure found in the full calculation. The possible connections between this model and experiment are discussed.

3913 Radiative and nonradiative charge transfer in He^++H collisions at low energy. Zygelman, B. (Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, Massachusetts 02138 (US)); Dalgarno, A.; Kimura, M.; Lane, N.F. *Physical Review [Section] A: General Physics (USA),* 40(5): 2340-2345 (1 Sep 1989). DOE Contract W-31-109-ENG-38.

We report the calculated cross sections for the removal of He^+ ions in collisions with hydrogen atoms for the collision energy range between 0.01 meV and 100 eV. Radiative association is the dominant mechanism at the low-energy extreme and for collision energies above 10 meV radiative charge transfer is dominant. Above 8 eV the radiative processes are negligible, and direct charge transfer is the primary removal mechanism. Using a quantum-mechanical method, we obtain the spectrum of the emitted radiation for the radiative charge transfer process at several collision energies. The emission spectrum has a main peak at wavelengths near 113 nm, which corresponds to the energy difference between the $A\,^1\Sigma^+$ and $X^1\Sigma^+$ states of the molecular ion HeH^+ at large internuclear distances. At higher collision energies, significant contributions to the emission spectra occur at shorter wavelengths, and distinct peaks appear. We interpret these peaks as a result of orbiting in the outgoing channel.

3914 Symmetric charge transfer to multiply charged ions. Bardsley, J.N. (Lawrence Livermore National Laboratory, Livermore, California 94550 (US)); Gangopadhyay, P.; Penetrante, B.M. *Physical Review [Section] A: General Physics (USA),* 40(5): 2742-2744 (1 Sep 1989). DOE Contract W-7405-ENG-48.

The asymptotic theory of symmetric charge transfer is adapted to apply to ion-ion collisions through allowance for curved nuclear trajectories. The theory compares well with *ab initio* quantum calculations on He^{2+}-He^+ collisions and is applied to five members from each of the Li-like and Na-like sequences.

3915 Effective *L*-shell fluorescence yields for sodiumlike and neonlike low-lying autoionizing states. Chen, M.H. (High Temperature Physics Division, Lawrence Livermore National Laboratory, Livermore, California 94550 (US)). *Physical Review [Section] A: General Physics (USA),* 40(5): 2758-2761 (1 Sep 1989). DOE Contract W-7405-ENG-48.

The statistically averaged L-shell fluorescence yields for the doubly excited $3l3l'$ and $3l4l'$ configurations of Na- and Ne-like ions have been calculated for ions with $18 \le Z \le 92$ using Dirac-Fock wave functions. The average n=3→2 radiative rates and Auger rates for the $3l3l'$ states of the Na-like ions scale as $Z^{5.1}$ and $Z^{0.71}$, respectively. The procedure for calculating the average fluorescence yield as ratio between the average x-ray rate and average total decay rate underestimates the average fluorescence yield by as much as a factor of 3 for low-Z ions and overestimates by 50% for heavy ions. Inclusion of $E2$ transitions leads to a 25% increase in the average fluorescence yield for the Na-like $3l3l'$ states at Z=80.

3916 Experimental study of atomic structure in strong electromagnetic fields. Szoke, A. (Lawrence Livermore National Laboratory, Livermore, California 94550 (US)); Landen, O.L.; Perry, M.D. *Physical Review [Section] A: General Physics (USA),* 40(5): 2766-2769 (1 Sep 1989). DOE Contract W-7405-ENG-48.

We have measured the energy spectrum of photoelectrons emitted in multiphoton ionization of atoms by a short-pulse, tunable laser. The spectrum shows prominent resonances, confirming the observations of Freeman *et al.* [Phys. Rev. Lett. 59, 1092 (1987)]. The study of the position and intensity of such resonances, as a function of laser wavelength and intensity, probes the structure of the atom in the presence of the strong electromagnetic field and allows their spectroscopic assignment. A systematic study of the ac Stark shift of one of the resonances, the $7s[3/2]^\circ$ level of xenon, is presented.

3917 Electron-impact ionization of La^{q+} ions (q=1,2,3). Muller, A. (Institut fur Kernphysik, Universitat Giessen, D-6300 Giessen, Federal Republic of Germany (DE)); Tinschert, K.; Hofmann, G.; Salzborn, E.; Dunn, G.H.; Younger, S.M.; Pindzola, M.S. *Physical Review [Section] A: General Physics (USA),* 40(7): 3584-3598 (1 Oct 1989).

Experimental cross sections for single ionization of La^+, La^{2+}, and La^{3+} ions as well as for double ionization of La^+ and La^{2+} ions and for triple ionization of La^{2+} ions are presented in an electron-impact energy range from threshold up to 1000 eV. By using a fast energy-scanning technique with step widths of about 40 meV and an energy resolution of 0.4 eV, fine details in the cross sections and especially resonant contributions could be observed. Resonant excitation of La^{2+} at 95 eV with subsequent emission of three electrons appears in our interpretation to account for 30% of the total measured double-ionization cross section. The data are interpreted on the basis of calculations of energy levels and distorted-wave calculations of direct ionization from various electron subshells and of excitation-autoionization processes. A detailed analysis of the La^{3+} single ionization both for ground-state and $5p^5 4f$ metastable ions is presented.

3918 Absolute differential cross sections for small-angle H^+-He direct and charge-transfer scattering at keV energies. Johnson, L.K. (Department of Physics, Department of Space Physics and Astronomy, and Rice Quantum Institute, Rice University, P.O. Box 1892, Houston, Texas 77251 (US)); Gao, R.S.; Dixson, R.G.; Smith, K.A.; Lane, N.F.; Stebbings, R.F.; Kimura, M. *Physical Review [Section] A: General Physics (USA),* 40(7): 3626-3631 (1 Oct 1989).

This paper reports measurements and calculations of absolute differential cross sections for H^+-He charge-transfer and direct scattering. Charge-transfer measurements have been obtained at 5.0 keV laboratory energy over the laboratory angular range 0.02°–1.0°, while direct scattering has been observed at 0.5, 1.5, and 5.0 keV laboratory energy over a closely corresponding angular range. Calculations are reported for 0.5, 1.5, and 5.0 keV charge-transfer and direct scattering. The measured cross sections are in good agreement with those derived from fully quantum-mechanical molecular-orbital close-coupling calculations. Direct scattering cross sections are also found to be in agreement with single-potential calculations using directly summed Jeffreys-Wentzel-Kramers-Brillouin phase shifts derived from proposed H^+-He ground-state interaction potentials. The cross sections exhibit significant structure over the range of angles and energies studied. The measured cross sections have been integrated over the experimental angular range providing absolute integral cross sections for comparison with theoretical results and previously measured total cross sections.

3919 Electron removal from molecular hydrogen by fully stripped ions at intermediate energies. Meng, L. (Department of Physics and Laboratory for Atomic and Molecular Research, University of Missouri-Rolla, Rolla, Missouri 65401-0249 (US))); Reinhold, C.O.; Olson, R.E. *Physical Review [Section] A: General Physics (USA),* 40(7): 3637-3645 (1 Oct 1989).

A classical phase-space model of the hydrogen molecule is presented and applied to the study of the electron-capture and -ionization processes in collisions of fully stripped ions with H_2 at intermediate impact energies and charge states from 1 to 10. The model is based on the independent-electron and the impact-parameter approximations. The electron–impinging-ion and electron–target-nuclei interactions are exactly taken into account. The interaction between the electrons is approximated by model potentials. The calculated total cross sections for production of free electrons and capture of one electron are in good agreement with different experimental data. The ratio between the capture cross sections from molecular and atomic hydrogen targets is also analyzed and compared with available empirical scalings. It is found that this ratio varies from a value less than 1 at low impact energy to 4 at higher energies. The reasons for these differences are discussed. A comparison is made between the capture cross sections for different orientations of the hydrogen molecule.

3920 Impact-parameter treatment of high-velocity electron capture from diatomic molecules at fixed orientation. Wang, Y.D. (J. R. McDonald Laboratory, Department of Physics, Kansas State University, Manhattan, Kansas 66506 (US)); McGuire, J.H.; Rivarola, R.D. *Physical Review [Section] A: General Physics (USA),* 40(7): 3673-3680 (1 Oct 1989).

Scattering of charged particles at high velocity from diatomic molecules is formulated in the impact-parameter treatment using a Fourier transform of the amplitude in the quantum-mechanical treatment. Probabilities and total cross sections are evaluated for electron capture for a fixed orientation of the intermolecular axis. Total cross sections, integrated over projectile impact parameters, for capture from H_2 predict variations of a factor of 2 or more for various orientations of the molecular axis. Capture from heteronuclear diatomic molecules is also considered.

3921 Single and double ionization of helium by hydrogen-atom impact. DuBois, R.D. (Pacific Northwest Laboratory, Richland, Washington, 99352 (US)); Kover, A. *Physical Review [Section] A: General Physics (USA),* 40(7): 3605-3612 (1 Oct 1989). DOE Contract AC06-76RL01830.

Cross sections for single and double ionization of helium resulting from pure ionization and from electron transfer (capture or loss) are reported for 25–1000-keV/u hydrogen-atom impact. The single-target ionization data are compared with existing first Born calculations. Good agreement is found above 200 keV, and inadequacies for specific channels at lower energies are identified. Double-target ionization is shown to occur more frequently for H^0 impact than for fast electron or proton impact. It is also demonstrated that, for impact energies greater than 150 keV, double ionization of helium results from a single projectile-target interaction.

3922 Natural line shape. Milonni, P.W. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Cook, R.J.; Ackerhalt, J.R. *Physical Review [Section] A: General Physics (USA),* 40(7): 3764-3768 (1 Oct 1989).

For many years there have been two expressions for the natural radiative line shape, depending on the form of the Hamiltonian assumed for the interaction of an atom with the radiation field. It is shown that this difference arises from artificial assumptions about the atom-field interaction, and that the same line shape is obtained from either form under the appropriate physical assumptions.

3923 Partial and total cross sections and multiplet structure in the photoionization of atomic manganese. Jimenez-Mier, J. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6201 (US)); Krause, M.O.; Gerard, P.; Hermsmeier, B.; Fadley, C.S. *Physical Review [Section] A: General Physics (USA),* 40(7): 3712-3720 (1 Oct 1989). DOE Contract AC05-84OR21400.

We determined the absolute partial photoionization cross section σ and the angular distribution parameter β of the $3d$, $3p$, and $3s$ photoelectrons in atomic manganese for $65 \leq h\nu \leq 250$ eV. The total photoionization cross section is in satisfactory accord with the single-particle Hartree-Slater calculation and in very good agreement with a relativistic time-dependent local-density-approximation calculation. Binding energies and intensity ratios of the $3s^{-1}$ and $3p^{-1}$ multiplet lines were obtained. Five lines were identified within the $3p^{-1}$ multiplet, and the measured spacings are close to those found in solid MnF_2. Similarly, the spacings in the $3s^{-1}$ multiplet are equal to the ones measured in solid MnF_2. There is good accord between our results for the angular-distribution parameter of the $3p^{-1}$ (^7P) line and those of Malutzki *et al.* [J. Phys. B 18, 1735 (1985)]. The intensity ratios of $^5P(1)$ to ^7P and $^5S(1)$ to ^7S were seen to increase slowly somewhat above their thresholds. More rapid variations of all multiplet ratios were found within about 30 eV of threshold.

3924 Coupled-channel calculations of partial capture cross sections in multiply charged ion collisions with hydrogen.

Hansen, J.P. (Institute of Physics, Bergen University, N-5007 Bergen, Norway (NO)); Taulbjerg, K. *Physical Review [Section] A: General Physics (USA),* 40(7): 4082-4084 (1 Oct 1989).

Partial cross sections for electron capture in 1–50-keV collisions of Ar^{6+} and Ar^{8+} with atomic hydrogen have been calculated using an atomic expansion including two complete principal shells of final states (n=4,5 for Ar^{6+} and n=5,6 for Ar^{8+}). The qualitative structure of the results is in good accord with a reaction window picture. The results for Ar^{6+} ions are in agreement with published experimental data when precaution is taken with respect to uncertainties in absolute normalization of the data and with respect to a proper analysis of translation energy spectra at lower impact energies. The limited experimental data for Ar^{8+} do not agree with the present results.

3925 **Measurement of relative electron-impact-excitation cross sections for Fe^{24+}.** Brown, C.M. (E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, D.C. 20375-5000 (US)); Feldman, U.; Doschek, G.A.; Seely, J.F.; LaVilla, R.E.; Jacobs, V.L.; Henderson, J.R.; Knapp, D.A.; Marrs, R.E.; Beiersdorfer, P.; and other *Physical Review [Section] A: General Physics (USA),* 40(7): 4089-4092 (1 Oct 1989). DOE Contract W-7405-ENG-48.

We present measurements of the relative electron-impact-excitation cross sections for the $1s^2\ {}^1S_0$–$1s2p\ {}^1P_1$, $1s^2\ {}^1S_0$–$1s2p\ {}^3P_2$, $1s^2\ {}^1S_0$–$1s2p\ {}^3P_1$, and $1s^2\ {}^1S_0$–$1s2s\ {}^3S_1$ transitions for the He-like ion, Fe^{24+}. The measurements were made at two electron energies: 6.86 and 9.94 keV. The cross-section measurements are compared with theoretical calculations.

3926 **Test of predicted $\Delta n \geq 1$ *L*-shell dielectronic-recombination cross sections.** Bernstein, E.M. (Department of Physics, Western Michigan University, Kalamazoo, Michigan 49008 (US)); Clark, M.W.; Tanis, J.A.; Woodland, W.T.; Berkner, K.H.; Schlachter, A.S.; Stearns, J.W.; DuBois, R.D.; Graham, W.G.; Morgan, T.J.; and others. *Physical Review [Section] A: General Physics (USA),* 40(7): 4085-4088 (1 Oct 1989).

The predicted charge-state dependence of dielectronic-recombination cross sections involving Δn>=1 *L*-shell excitation has been tested by measurements of resonant transfer and excitation (RTE) for $_{41}Nb^{q+}+H_2$ (q=28 to 32) collisions at 3.7 and 4.0 MeV/u. The measured RTE cross sections increase significantly with increasing charge state and thus disagree substantially with theoretical calculations that predict essentially equal cross sections for Nb^{29+}, Nb^{30+}, and Nb^{31+}. This disagreement is contrary to the good agreement previously found between theory and experiment for *K*-shell RTE.

3927 **Structure and bonding in the B_2H_5 radical and cation.** Ruscic, B. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Schwarz, M.; Berkowitz, J. *Journal of Chemical Physics (USA),* 91(7): 4183-4188 (1 Oct 1989). DOE Contract W-31-109-ENG-38.

The B_2H_5 radical has been generated by the $F+B_2H_6$ reaction, and studied by photoionization mass spectrometry. The photoion yield curve for $B_2H^+{}_5$ (B_2H_5) is extremely weak at the adiabatic threshold (~6.945 eV), at least three orders of magnitude weaker than at its maximum (~9.67 eV). This observation provides support for recent *ab initio* calculations, which predict a singly bridged B_2H_5 and a triply bridged $B_2H^+{}_5$ as ground states. Evidence is presented for the coexistence of a doubly bridged B_2H_5 isomer, ~3 kcal/mol higher in energy. From the appearance potential of $B_2H^+{}_3$ (B_2H_5), a B_2H_5–H bond energy of $\lesssim$102.7 kcal/mol is obtained. From the photoion yield curve of $B_2H^+{}_3$ (B_2H_5), at least one, and perhaps two, excited states of $B_2H^+{}_5$ can be inferred. The lower one also branches into parent B_2H_5, an apparent violation of QET.

3928 **Theoretical study of the ionization of B_2H_5.** Curtiss, L.A. (Argonne National Laboratory, Chemical Technology Division/Materials Science Division, Argonne, Illinois 60439-4837 (US)); Pople, J.A. *Journal of Chemical Physics (USA),* 91(7): 4189-4192 (1 Oct 1989). DOE Contract W-31-109-ENG-38.

Ab initio molecular orbital calculations at the G1 level of theory have been carried out on neutral B_2H_5 radical, doubly bridged $B_2H^+{}_5$ cation, and the first triplet excited state of $B_2H^+{}_5$. Singly bridged B_2H_5 is 4.0 kcal/mol (without zero-point energies) more stable than doubly bridged B_2H_5. Based on this work and previous theoretical work on triply bridged $B_2H^+{}_5$, ionization potentials (vertical and adiabatic) are determined for B_2H_5. The adiabatic ionization potentials of the two B_2H_5 structures are 6.94 eV (singly bridged) and 7.53 eV (doubly bridged). A very large difference is found between the vertical and adiabatic ionization potentials (3.37 eV) of the singly bridged B_2H_5 structure. The first triplet state of $B_2H^+{}_5$ is found to be 4.55 eV higher in energy than the lowest energy $B_2H^+{}_5$ cation (triply bridged). The results of this theoretical study support the interpretation of Ruščic, Schwarz, and Berkowitz of their recent photoionization measurements on B_2H_5.

3929 **Fluorescence near a phase-conjugating mirror: Amplification of quantum noise.** Milonni, P.W. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Bochove, E.J.; Cook, R.J. *Physical Review [Section] A: General Physics (USA),* 40(7): 4100-4102 (1 Oct 1989).

We consider the spontaneous emission by an atom near a phase-conjugating mirror (PCM). The effect of the PCM on the decay rate may be understood equivalently in terms of vacuum-field modes reflected and conjugated by the PCM, or in terms of vacuum modes transmitted and amplified without conjugation by the PCM.

3930 **Solutions to the time-dependent three-dimensional Schroedinger equation: Atoms in intense electric fields.** Collins, L.A. (Group T-4, MS B212, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Merts, A.L. *Physical Review [Section] A: General Physics (USA),* 40(7): 4127-4130 (1 Oct 1989).

We develop a technique for solving the time-dependent three-dimensional Schroedinger equation by expanding in terms of a set of Volkov functions and converting to a system of first-order temporal equations. Solutions are obtained through standard multivalue propagation schemes. We apply the method to several cases including the interaction of an intense, oscillating electric field with a model three-dimensional atomic system, observing the above-threshold ionization structure.

3931 **Direct determination of scattering time delays using the *R*-matrix propagation method.** Walker, R.B. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Hayes, E.F. *Journal of Chemical Physics (USA),* 91(7): 4106-4110 (1 Oct 1989). DOE Contract W-7405-ENG-36.

A direct method for determining time delays for scattering processes is developed using the *R*-matrix propagation method. The procedure involves the simultaneous generation of the global *R* matrix and its energy derivative. The necessary expressions to obtain the energy derivative of the *S* matrix are relatively simple and involve many of the same matrix elements required for the *R*-matrix propagation method. This method is applied to a simple model for a chemical reaction that displays sharp resonance features. The test results of the direct method are shown to be in excellent agreement with the traditional numerical differentiation method for scattering energies near the resonance energy. However, for sharp resonances the numerical differentiation method requires calculation of the *S*-matrix elements at many closely spaced energies. Since the direct method presented here involves calculations at only a single energy, one is able to generate accurate energy derivatives and time delays much more efficiently and reliably.

3932 **Solution of reference interaction site model for mixtures of short-chain polyatomic molecules.** Wu, R. (School of Chemical Engineering and Materials Science, University of Oklahoma, Norman, Oklahoma 73019 (US)); Lee, L.L.; Harwell, J.H. *Journal of Chemical Physics (USA),* 91(7): 4254-4264 (1 Oct 1989).

Mixtures of chain molecules—monomers, dimers, trimers, and tetramers—are studied using the soft interaction site model. The site–site Ornstein–Zernike equations are solved using the Percus–Yevick closure. The site–site potential is of the Lennard-Jones 12-6 type. The method of solution, based on the efficient algorithm of Labik and employing Newton–Raphson accelerations, is shown to be fast, accurate and stable; it also shows good convergence behavior even with inaccurate initial estimates. New symmetrical properties among the atom–atom pairs are used to simplify the Jacobian matrix of solution. Pure as well as mixture systems are investigated. Comparison with simulation data of Banon *et al.* and Massobrio *et al.* is made. The structure is qualitatively described by

the integral equations. The internal energy is well predicted by the reference interaction site model calculations.

3933 **Quantum state-resolved study of pure rotational excitation of CO_2 by hot atoms.** Hershberger, J.F. (Department of Chemistry and Columbia Radiation Laboratory, Columbia University, New York, New York 10027 (US)); Hewitt, S.A.; Sarkar, S.K.; Flynn, G.W.; Weston, R.E. Jr. *Journal of Chemical Physics (USA)*, 91(8): 4636-4642 (15 Oct 1989). DOE Contract FG02-88ER13937;FG05-85ER75213.

Rotationally inelastic scattering of carbon dioxide by translationally hot H, D, and Cl atoms was studied by time-resolved diode laser absorption. The high *J* rotational distribution falls off quite rapidly between *J*=60 and *J*=80. D atom collisions have roughly twice the excitation cross section versus H atom collisions, with the H*/D* ratio decreasing with increasing *J*. These results are consistent with a constraint on the total reagent orbital angular momentum available for rotational excitation. Transient Doppler profiles measured immediately after hot atom/CO_2 collisions indicate that CO_2 molecules excited to high *J* levels have a larger recoil velocity than molecules excited to lower *J* levels. This result is consistent with predictions based on a simple model which treats the CO_2 potential as a hard shell ellipsoid.

3934 **Theroretical study of $B_2H^+_3$, $B_2H^+_2$, and B_2H^+.** Curtiss, L.A. (Chemical Technology Division/Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439-4837 (US)); Pople, J.A. *Journal of Chemical Physics (USA)*, 91(8): 4809-4812 (15 Oct 1989). DOE Contract W-31-109-ENG-38.

An *ab initio* molecular orbital study is presented of $B_2H^+_3$, $B_2H^+_2$, and B_2H^+ at the G1 level of theory, including correlation energy beyond fourth-order perturbation theory and large basis sets. The structures of these ions are found to contain no hydrogen bridges in contrast to the previously studied ions ($B_2H^+_6$, $B_2H^+_5$, and $B_2H^+_4$) in this series. Good agreement is found with a recent photoionization measurement of the appearance potentials of the $B_2H^+_3$ and $B_2H^+_2$ ions from B_2H_6.

6404 Fluid Physics

Refer also to citation(s) 2516

3935 (AD-A–210465/1/XAB) **Numerical simulation of the compressible Orszag-Tang vortex. Interim report, June 1988-February 1989.** Dahlburg, R.B.; Picone, J.M. Naval Research Lab., Washington, DC (USA). 8 Jun 1989. 53p. (NRL-MR–6486). Available from NTIS, PC A04/MF A01.

Results of fully compressible, Fourier collocation, numerical simulations of the Orszag-Tang vortex system are presented. Initial conditions consist of a nonrandom, periodic field in which the magnetic and velocity fields contain X-points but differ in modal structure along one spatial direction. The velocity field is initially solenoidal, with the total initial pressure-field consisting of the superposition of the appropriate incompressible pressure distribution upon a flat pressure field corresponding to the initial, average flow Mach number of the flow. In the numerical simulations, this initial Mach number is varied from 0.2 to 0.6. These values correspond to average plasma beta values ranging from 30.0 to 3.3, respectively. Compressible effects develop within one or two Alfven transit times, as manifested in the spectra of compressible quantities such as mass density and nonsolenoidal flow field. These effects include (1) retardation of growth of correlation between the magnetic field and the velocity field, (2) emergence of compressible small-scale structure such as massive jets, and (3) bifurcation of eddies in the compressible-flow field. Differences between the incompressible and compressible results tend to increase with increasing initial average Mach number.

3936 (AD-A–210586/4/XAB) **Experimental study of microwave transmission through a decaying plasma. Final report, January 1986-February 1988.** Hendricks, K.J. Air Force Weapons Lab., Kirtland AFB, NM (USA). May 1989. 31p. (AFWL-TR–89-35). Available from NTIS, PC A03/MF A01.

Original contains color plates: All DTIC reproductions will be in black and white.

The physics of pulsed-microwave, or radio-frequency (r-f), transmission through a decaying plasma column, is studied experimentally. A plasma column is formed in argon or nitrogen gases, to represent the neutral-gas breakdown due to an rf pulse. Initially, the electron frequency is greater than the microwave frequency. An r-f pulse capable of plasma reionization is applied across the plasma column at varying times in the plasma's decay phase (the plasma afterglow). Variation of the transmitted rf pulse characteristics, pulse width, and amplitude was studied as a function of the time into the afterglow. The ionization frequency of argon by a microwave pulse is found experimentally to be within 20% of the theoretical value. The comparison of ionization frequency is useful in establishing the applicability of earlier cavity measurements to present-day open-geometry systems used in transmission/propagation experiments.

3937 (EGG-M–38887) **Simulations of local Nusselt number using an algebraic stress model (ASM) for turbulent flow in a square 180 degree bend.** Johnson, R.W. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-880469–2: 2. international symposium on transport phenomena, dynamics, and design of rotating machinery, Honolulu, HI (USA), 3-6 Apr 1988). Order Number DE90001998. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Numerical simulations for local Nusselt number for the curved three-dimensional incompressible turbulent flow of air with heat transfer in a square-sectioned duct with a 180° bend are presented and compared with experiment. Predictions are obtained using an algebraic stress model (ASM) of turbulence, which has a better track record for curved flows than eddy viscosity models. The effects of employing central/upwind differencing vs. quadratic upwinding for convective coefficients, a "local equilibrium" wall treatment vs. one that allows diffusion of turbulent kinetic energy and staggered vs. unstaggered locations for turbulent shear stresses are examined. The numerical results are obtained using a finite-volume discretization of the Reynolds and energy equations employed in a semi-elliptic algorithm that marches iteratively through the flow domain. Objectives of the present study are to examine the behavior of the ASM, and wall treatments, which have been tuned against 2-D data, in predicting the local Nusselt number Nu for the present 3-D flow (Re = 55 565). 35 refs., 8 figs.

3938 **Quantum fluids and solids, 1989.** AIP Conference Proceedings 194. Ihas, G.G.; Takano, Yasumasa (eds.). 429p. American Institute of Physics, New York, NY (USA) (1989). Sponsored by American Institute of Physics. (CONF-8904257–: Quantum fluids and solids, Gainesville, FL (USA), Apr 1989).

This report contains papers on the following topics: tunneling and phase slippage in superfluids; superfluid ^{3}He; quantum interactions; low dimensional helium; polarized quantum systems; solid helium; nuclear magnetic ordering; exotic studies at low temperatures; and low temperature techniques. Papers from this report are indexed separately. (LSP)

3939 **Statistical properties and numerical implementation of a model for droplet dispersion in a turbulent gas.** O'Rourke, P.J. (Theoretical Division, Group T-3, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)). *Journal of Computational Physics (USA)*, 83(2): 345-360 (Aug 1989).

We explore the statistical properties of a model proposed by Dukowicz for calculating the dispersion of spray droplets due to turbulent gas motions. The distributions of turbulent velocity and position changes are derived, making no assumptions concerning the relative magnitudes of the drag time, turbulence correlation time, and the time at which the distributions are evaluated. We also tell how the model is implemented in the computer program KIVA and give some computational examples. © 1989 Academic Press, Inc.

3940 **Current drive via magnetohydrodynamic helicity waves.** Mett, R.R. (University of Wisconsin, Madison, Wisconsin 53706 (US)); Tataronis, J.A. *Physical Review Letters (USA)*, 63(13): 1380-1383 (25 Sep 1989).

We explore fundamentals of low-frequency current drive produced by a packet of arbitrarily polarized nonlinear shear Alfven waves in an infinite, uniform magnetized plasma. Analysis of the magnetohydrodynamic equations with resistivity and viscosity yields coupled

nonlinear equations for the Alfven wave amplitude and an induced magnetic field. Particular solutions relate the plasma current to the helicity of the Alfven wave and the difference between the viscosity and magnetic diffusivity.

3941 **Stability of core-annular flow in a rotating pipe.** Hu, H.H. (Department of Aerospace Engineering and Mechanics, University of Minnesota, Minneapolis, Minnesota 55455 (US)); Joseph, D.D. *Physics of Fluids A: Fluid Dynamics (USA),* 1(10): 1677-1685 (Oct 1989).

The linear stability of core-annular flow in rotating pipes is analyzed. Attention is focused on the effects of rotating the pipe and the difference in density of the two fluids. Both axisymmetric and nonaxisymmetric disturbances are considered. Major effects of the viscosity ratio, interfacial tension, radius ratio, and Reynolds number are included. It is found that for two fluids of equal density the rotation of the pipe stabilizes the axisymmetric (n=0) modes of disturbances and destabilizes the nonaxisymmetric modes. Except for small R, where the axisymmetric capillary instability is dominant, the first azimuthal mode of disturbance $|n|$=1 is the most unstable. When the heavier fluid is outside centripetal acceleration of the fluid in the rotating pipe is stabilizing; there exists a critical rotating speed above which the flow is stabilized against capillary instability for certain range of small R. When the lighter fluid is outside the flow is always unstable.

6450 High Energy Physics

3942 **Proceedings of the Storrs meeting.** Haller, K.; Caldi, D.G.; Islam, M.M.; Mallett, R.L.; Mannheim, P.D.; Swanson, M.S. (eds.). 941p. World Scientific Publishing Co., Inc., Teaneck, NJ (USA) (1989). Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG02-88ER40434. From 4. meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT (USA); 15-18 Aug 1988.

This report contains papers on the following topics: lattice gauge theory; non-accelerator particle physics; weak mixing and CP violation; accelerators and detectors; heavy flavors and spectroscopy; $\bar{p}$-p physics; electron-positron physics; QCD and strong interaction models; QCD and fixed target physics; electroweak and beyond; current topics in field theory; strings and superunification; cosmology and the early universe; and non-Newtonian gravity. The individual papers are indexed separately.

3943 (DOE/ER–0412) **The ultimate structure of matter: The US High Energy Physics Program from the 1950s through the 1980s.** USDOE Office of Energy Research, Washington, DC (USA). Oct 1989. 43p. Sponsored by U.S. DOE Energy Research. Order Number DE90001784. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the following topic in high energy physics: the particle zoo; the strong and the weak; the particle explosion; deep inside the nucleon; the search for unity; physics in collision; the standard model; particles and the cosmos; and practical benefits.

3944 (DOE/ER/05490–107) **Research in elementary particle physics: Progress report, March 1, 1989–February 28, 1990.** Chan, Lai-Him; Haymaker, R.; Imlay, R.; McNeil, R.; Metcalf, W. Louisiana State Univ., Baton Rouge, LA (USA). 1990. 129p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-77ER05490. Order Number DE90002525. Available from NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

We describe theoretical work on effective action expansion of an effective low energy theory of hadrons, dynamical symmetry breaking, and lattice gauge theories. The high energy experimental group at Louisiana State University has finished taking data on a neutrino oscillation experiment at LAMPF. Results for the 1987 data have been published. Analysis of 1988 and 1989 data is in progress. LSU is also participating in an electron-positron experiment, AMY, that is running at TRISTAN in Japan. LSU is responsible for the muon detector for AMY. Many results have been published. We have recently joined an electron-proton experiment, ZEUS.

3945 (DOE/ER/40224–85) **[Theory of elementary particles studies in weak interaction and grand unification and studies in accelerator design]: Annual report, Task A.** Oregon Univ., Eugene, OR (USA). [1989]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. Order Number DE90003326. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report discusses topics on: Rare B decay; Physics beyond the standard model; Intermittency; Relativistic heavy-ion collisions; Cross section for jet production in hadron collisions; Factorization; Determination of the parton distribution function; Left-right electroweak theories; and Supersymmetry at Lepton colliders. (LSP)

3946 (LA–11670-PR) **Progress at LAMPF: Progress report, January–December 1988.** Poelakker, K. Los Alamos National Lab., NM (USA). Sep 1989. 213p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE90001809. Available from NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.

This report discusses project experiments done at Lampf under the following topics: nuclear and particle physics; astrophysics; atomic and molecular physics; materials science; nuclear chemistry; radiation effects; radioisotope production; and theory.

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 3260, 3330, 3332, 3974

3947 (AD-A–207482/1/XAB) **Potential for a near-term very-low-energy antiproton source at Brookhaven National Laboratory. Special report.** Nordley, G.D. Air Force Astronautics Lab., Edwards AFB, CA (USA). Apr 1989. 197p. (AFAL-SR–89-001). Available from NTIS, PC A09/MF A01.

The resolution of key issues in the use of antimatter for applications ranging from aerospace-materials analysis in the near term and propulsion energy storage in the far term requires experiments with low-energy, relatively slow-moving, or thermal, antiprotons. There is no United States source of antiprotons at that energy; therefore, a task was initiated with Brookhaven National Laboratory to determine what would be required in time, equipment, and money to create a source producing antiprotons at a rate (approx 10^{14}/yr) sufficient to support applications experiments. The estimate eventually derived from this first-order analysis was approximately $8.6M for an initial source of 20 KeV antiprotons plus another roughly estimated $5M for cooling to increase the production rate to 10^{14} - 10^{15} antiprotons per year.

3948 (DOE/ER/40150–89) **Outlook and perspectives (excited baryons, 1988).** Walecka, J.D. Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. [1988]. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84ER40150. (CEBAF-PR–88-015;CONF-881049–81: 14. linear accelerator conference (LINAC-14), Williamsburg, VA (USA), 3-7 Oct 1988). Order Number DE90000772. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper is a talk on excited baryons with B = 1. Interactions, resonances, structure and properties of the baryon is discussed. A historical perspective is given. 18 refs., 13 figs. (LSP)

3949 (DOE/ER/40193–T3) **Investigation of physical structures and interactions at high energy: [Progress report, October 1988–October 1989].** Iowa State Univ. of Science and Technology, Ames, IA (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-85ER40193. Order Number DE90003368. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The present experiment, E-735, is a search for a deconfined quark-gluon plasma phase of hadronic matter predicted to occur when temperatures of 240 MeV are achieved. The primary data were obtained in 1988–1989, and operations concluded with the current phase of the Fermilab Tevatron Collider in May 1989. Based on these data, the collaboration is analyzing the charged particle multiplicity and transverse momentum distributions, with particle identification, of the produced secondaries. These measurements are regarded on theoretical grounds to be sensitive indicators of the

formation of a high-temperature plasma. First results will be described. The next experimental program, experiment L3 at LEP/CERN, is presented, and the role of Iowa State University is outlined. There is a long and well-known history establishing the importance of precision measurements of photons and leptons, and the L3 detector represents the current state of the art in these measurements. Our previous experience in high-level triggers, data acquisition systems, high-precision detectors, and e^+e^- technology and physics will contribute significantly to the L3 program.

3950 (DOE/ER/40389–61) **$K_L^0 \rightarrow \mu^{\mp}e^{\pm}$ at the Fermilab main injector.** Cooper, M.D.; McFarlane, W.K.; Shinkawa, T. Temple Univ., Philadelphia, PA (USA). Dept. of Physics. [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40389. (CONF-890872–3: Workshop on physics at Fermilab in the 1990's, Breckenridge, CO (USA), 15-24 Aug 1989). Order Number DE90002566. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Some of the attempts to replace the Standard Model with more satisfactory theories result in predictions that lepton flavor (separate lepton number) is not absolutely conserved. A new generation of experiments is underway to study decays in which lepton flavor conservation might be violated, such as $K_L^0 \rightarrow \mu^{\mp}e^{\pm}$, $K^+ \rightarrow \pi^+\mu^+e^-$, $\mu \rightarrow e\gamma$, $\mu \rightarrow eee$, and $\mu^-A \rightarrow e^-A$. Since the form of a lepton number violating interaction is unknown, it is useful to probe all of these decays, and perhaps decays of B and D mesons, to whatever level is technically feasible. However, here we concentrate on the decay $K_L^0 \rightarrow \mu^{\mp}e^{\pm}$. The three most recent experiments on this process have been E780 at BNL, E791 at BNL, and KEK E137, which currently report (90% C.L.) upper limits on the branching fraction of 1.9×10^{-9}, 2.2×10^{-10}, and 4.3×10^{-10} respectively. While E780 is complete, the two other experiments are in the process of collecting larger samples and a combined sensitivity of about 2×10^{-11} is likely (by sensitivity we mean the branching fraction which would produce one observed event). Any new experiment should aim at a sensitivity of 10^{-13}. There are several places which might offer a suitable beam: the BNL AGS with the Booster, the Fermilab Main Injector (MI), and the TRIUMF KAON facility. 5 refs.

3951 (DOE/ER/40389–62) **Experimental investigations in particle physics at intermediate energies: Performance report, December 1, 1988–December 31, 1989.** Auerbach, L.B.; Highland, V.L.; Martoff, C.J.; McFarlane, K.W.; Buchholz, P.; Sivertz, M.B. Temple Univ., Philadelphia, PA (USA). Dept. of Physics. 31 Oct 1989. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40389. Order Number DE90002565. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The major emphasis of this project continues to be on fundamental symmetries and parameters of the Standard Model. The primary project is BNL E791, a search for the decay $K_L^0 \rightarrow \mu e$, which would violate the rule of separate lepton number conservation. The technique uses a drift-chamber spectrometer, with particle identification, picking out candidate decays from 2-particle triggers by measuring the two-particle invariant mass m, and the collinearity angle Θ_c. For reconstructed $K_L^0 \rightarrow \pi^+\pi^-$ decays the rms resolution in m was $\sim$1.4 MeV/c^2, and in Θ_c it was $\sim$0.3 mrad; these values match the design specifications. All the data from the 1988 run of E971 have been analyzed for K_L^0 μe, $K_L^0 \rightarrow \mu e$, $K_L^0 \rightarrow \mu\mu$, and $K_L^0 \rightarrow ee$ events, and the results submitted for publication. We find an upper limit from the 1988 data for the branching fraction of $K_L^0 \rightarrow \mu e$ of 2.2×10^{-10} and a limit of 3.1×10^{-10} for $K_L^0 \rightarrow ee$. We also measured the branching fraction for K_L^0 $\mu\mu$ to be $(5.8 \pm 0.6 \pm 0.4) \times 10^{-9}$, with a sample of 87 events. Our limits are the best reported. The limit on the decay $K_L^0 \rightarrow \mu e$ places a lower limit on the mass of a new particle mediating such decays of 50 TeV. The other neutrino work at Los Alamos, E764, will result in a final publication. Calculations are being completed of the neutrino flux, necessary for the measurement of the ν_μ ^{12}C inclusive cross sections. These will be the best measurements of ν-nuclear scattering.

3952 (DOE/ER/40416–2) **[A high sensitivity search for MU Gamma: The Mega experiment at LAMPF]: Progress report, January 15, 1989–October 15, 1989.** Valparaiso Univ., IN (USA). 10 Nov 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40416. Order Number DE90003182. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This report describes the work done at Valparaiso University on LAMPF experiment E764, to conclude the neutrino flux calculations, and work done at Valparaiso University and at LANL on LAMPF E969, the MEGA experiment, specifically on the positron arm of the MEGA spectrometer.

3953 (FNAL/C–89/207-E) **Recent results from the CDF [Collider Detector at Fermilab] experiment at the Tevatron proton-antiproton collider.** Geer, S. CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1989. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8907162–1: 8. Eloisatron Project workshop on Higgs Boson, Erice (Italy), 15-26 Jul 1989). Order Number DE90002186. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent results from the CDF experiment are described. The Standard Model gives a good description of jet production, and W/Z production and decay. There is no evidence yet for the top quark, for fourth generation quarks, or for deviations from the Standard Model ascribable to quark substructure, supersymmetric particles, or heavy additional W-like or Z-like bosons. Limits are given where applicable. A search for a light Higgs Boson is also described. 11 refs., 24 figs.

3954 (IC–89/137) **Search for proton decay and supernova neutrino bursts with a lunar base neutron detector.** Cline, D.B. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 23p. Order Number DE90607644. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We describe the current status of the search for proton decay on earth, emphasizing the decay mode P -> $K^+\nu^-$ and discuss the possibility of detecting this mode with a single detector on a lunar base station. The same detector could be used to search for neutrino bursts from distant supernova using the neutral current signature $\nu_{\mu,tau}$+N -> n+ν_x by detecting the produced neutrons. The key advantage of the lunar experiment is the low neutrino flux and possible low radioactive background. (author). 5 refs, 4 tabs, 3 figs.

3955 (INIS-mf–12013, pp. 117-118) **Measurement of proton-antiproton cross sections at low momenta.** Brueckner, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Dworschak, K.; Povh, B.; Paul, S.; Cujec, B.; Doebbeling, H.; Shibata, T.A.; Kneis, H.; Nomachi, M.; Ransome, R.D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Measurements of antiproton-proton cross sections at the LEAR facility of CERN have been performed in 1983-86, and the analysis of the data is in progress. This year we have completed the analysis of the S-resonance search in the annihilation cross section. No structure for such a resonance is seen around the beam momentum of 500 MeV/c. The upper limit for the resonance has been derived from this result. The analysis of the annihilation cross section has been further extended down to 180 MeV/c. It is found that the annihilation cross section is larger than the geometrical limit of pure s-wave, indicating a sizable contribution of p-wave even at very small beam momenta. (orig.).

3956 (INIS-mf–12013, pp. 118-122) **Deep-inelastic myon-nucleus scattering at the CERN SPS; EMC and NMC Collaboration.** Alberich, T.; Bird, I.G.; Brueckner, W.; Dierberger, B.; Doebbeling, H.; Harrach, D. von; Kabuss, E.M.; Mizuno, Y.; Mueller, A.; Mueller, B. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Our group is involved in deep inelastic muon nucleon and muon nucleus experiments performed by the EMC and NMC collaborations at the CERN SPS. The evaluation of the polarized target data of the EMC has been finalized. A significant violation of the Ellis-Jaffe sum rule is found. In addition the deep inelastic data on nuclear targets (D_2, C, Cu, Sn), obtained parasitically to the polarized target run, have been analysed. Together with preliminary results of the NA28 shadowing experiment of the EMC on Ca-D

they provide for the first time evidence that shadowing in deep inelastic scattering persists for $Q^2>3$ GeV^2. (orig.).

3957 (INS–747) **Study of hypernuclei via (π^+, K$^+$) reactions at KEK.** Akei, M.; Amann, J.F.; Chiba, J. and others. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. May 1989. 9p. Order Number DE90719711. Available from NTIS (US Sales Only), PC A02/MF A01.

Since the possibility of using a (π^+, K$^+$) reaction for studying of hypernuclei was first suggested by Thiessen, interesting theoretical and experimental works have been reported. The present report briefly outlines the performance of the PIK spectrometer, results of $^{12}C(\pi^+, K^+)_\Lambda{}^{12}C$ and $^{56}Fe(\pi^+, K^+)_\Lambda{}^{56}Fe$ reactions, and estimation of the asymmetry of the decaying particle from a polarized$_\Lambda{}^{12}C$ hypernucleus. The PIK spectrometer has been installed at the K2 beam line at KEK. It shows good performance for studying (π^+, K$^+$) reactions. The $^{12}C(\pi^+, K^+)_\Lambda{}^{12}C$ and $^{56}Fe(\pi^+, K^+)_\Lambda{}^{56}Fe$ reactions are studied by means of the PIK spectrometer. The observed spectrum is consistent with a calculation made in a framework of the single neutron hole + lambda single particle system and DWIA for the (π^+, K$^+$) reaction. Refined calculation taking into account the effect of pairing correlation and spreading of neutron hole states seems to give better agreement with the spectrum in the effective Λ bound region. Since the PIK spectrometer gives spectra with small background and has reasonably large acceptance, it is quite feasible to carry out coincidence experiments. The estimated large asymmetry of the nonmesonic decay of the polarized hypernuleus may promise the observation of polarized hypernuclei by using the PIK spectrometer. If they are found to exist, it will open a new field or hypernuclear spectroscopy. (N.K.).

3958 (INS–752) **Possible measurement of the gravitational acceleration of molecules, atoms, nuclei, elementary particles and antiparticles.** Terazawa, Hidezumi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jun 1989. 11p. Order Number DE90719559. Available from NTIS (US Sales Only), PC A03/MF A01.

A possible laboratory measurement of the gravitational acceleration of ionized molecules, ionized atoms, nuclei, charged elementary particles and charged antiparticles is proposed. It is simple by detecting their falling distance to an accuracy of the order of 1μm after one turn of circular orbit with a radius of the order of 1m in the variable static homogeneous weak magnetic field of the orders of 10^{-3}-1 gauss, which is available in the air-core β spectrometer. The technical points are also presented and discussed in detail. (author).

3959 (LA-UR–89-3695) **Neutrino mass: Recent results.** Robertson, R.G.H. Los Alamos National Lab., NM (USA). 1989. 19p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-890979–1: Fundamental symmetries in nuclei and particles, Pasadena, CA (USA), 7-9 Sep 1989). Order Number DE90003171. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Some recent developments in the experimental search for neutrino mass are discussed. Simpson and Hime report finding new evidence for a 17-keV neutrino in the β decay of ^{3}H and ^{35}S. New data from Los Alamos on the electron neutrino mass as measured in tritium beta decay give an upper limit of 13.5 eV at the 95% confidence level. This result is not consistent with the long-standing ITEP result of 26(5) eV within a "model-independent" range of 17 to 40 eV. It now appears that the electron neutrino is not sufficiently massive to close the universe by itself. 38 refs., 1 figs., 2 tabs.

3960 (LBL–27599) **Low energy $\bar{p}p$ physics.** Amsler, C.; Crowe, K. Lawrence Berkeley Lab., CA (USA). Feb 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8902143–1: Workshop on hadron spectroscopy, Vancouver (Canada), 21 Feb 1989). Order Number DE90002452. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A detailed investigation of proton-antiproton interactions at low energy has become feasible with the commissioning of the LEAR facility in 1983. We shall shortly review the status of $\bar{p}p$ annihilation at rest and the physics motivations for second generation experiments with the Crystal Barrel detector. This type of detector would be adequate for the study of both Kp and $\bar{p}p$ interactions on an extracted beam of the KAON Factory. We shall conclude with a few remarks on the physics opportunities with $\bar{p}$'s at the KAON Factory which, in our opinion, will not be covered by the present LEAR facility. 11 refs., 10 figs., 2 tabs.

3961 (RAL–89-026) **Particle physics experiments 1988.** Bairstow, R. Rutherford Appleton Lab., Chilton (UK). 1989. 157p. Order Number DE90607643. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

This report describes work carried out in 1988 on experiments approved by the Particle Physics Experiments Selection Panel. The contents consist of unedited contributions from each experiment. More than forty projects at different accelerators (SPS, ISIS, PETRA, LAMPF, LEP, HERA, BNL, ILL, LEAR) are listed. Different organisations collaborate on different projects. A brief progress report is given. References to published articles are given. (author).

3962 (SLAC–343) **Proceedings of the tau-charm factory workshop: Study of tau, charm and J/psi physics; development of high luminosity esup +esup minus rings; design of esup +esup minus detectors for tau-charm physics.** Beers, L.V. (ed.). Stanford Linear Accelerator Center, Menlo Park, CA (USA). Jun 1989. 976p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8905144–: Tau-Charm Factory workshop, Stanford, CA (USA), 23-27 May 1989). Order Number DE90001785. Available from NTIS, PC A99/MF A01; OSTI; INIS; GPO Dep.

This report contains papers on the following main topics: machine physics; tau physics; D and D_s physics; J/Ψ and charmonium physics; tau charm factories; workshop summary; accelerator physics; tau physics; charmed meson physics; J/Ψ and charmonium physics; and detector.

3963 (SLAC–347) **Study of four-lepton final states in electron-positron interactions at 29 GeV.** Petradza, A. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Aug 1989. 129p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90002629. Available from NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This thesis presents a study of electron-positron scattering to four light leptons. The motivations behind it are twofold. Firstly, the study is a test of the theory of electron-positron interactions to 4th order in the fine structure constant α. A deviation from the theory could indicate the existence of a heavy new particle. Secondly, a measurement of these processes may prove useful in the understanding of other QED-type reactions. The method for simulating the four-lepton processes by the Monte Carlo event generator of Berends, Daverveldt and Kleiss is described. Theoretical predictions are compared to data from the Mark II and HRS experiments at the PEP storage ring. The observed events consist of four leptons at large angles. Data for all three $e^+e^-e^+e^-$, $e^+e^-\mu^+\mu^-$ and $\mu^+\mu^-\mu^+\mu^-$ processes are well described by the QED Monte Carlo calculation. The various kinematical distributions are in good agreement with QED to order α^4. 18 refs., 64 figs., 19 tabs.

3964 (SLAC–350) **A search for single electron production in electron positron annihilation at E = 29 GeV.** Steele, T.R. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Sep 1989. 124p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90002638. Available from NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This thesis presents experimental results from the ASP detector which took data on e^+e^- interactions in the PEP storage ring at SLAC. Its design was particularly suitable for searching for production of supersymmetric particles. The motivations for and phenomenology of Supersymmetry are discussed. In particular, the production of a single supersymmetric electron ("selectron", $\tilde{e}$) in combination with a supersymmetric photon ("photino", $\tilde{\gamma}$) would result in events in which a single electron and no other particles are observed in the detector at an e^+e^- collider such as PEP, provided the masses of these particles are not too large. Such events would also result from the production of a single supersymmetric W-boson ("wino", $\tilde{W}$) in combination with a supersymmetric neutrino ("sneutrino", $\tilde{\nu}$). These processes make it possible to search for electrons and winos with masses greater than the beam energy. Observation

of these unusual events would distinctly indicate the production of new particles. The ASP detector was designed to be hermetic and to provide efficient event reconstruction for low multiplicity events. The detector is described and its performance is evaluated; it is found to be well-suited to this study. The data sample collected with the detector was thoroughly analyzed for evidence of single-electron events. The various possible background processes are considered and Monte Carlo calculations of the distributions from single selectron and single wino production are presented. Using this information an efficient off-line event selection process was developed, and it is described in detail. 82 refs., 41 figs., 4 tabs.

3965 (SLAC-PUB–4984) **Rare decays.** Gilman, F.J. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Sep 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8904226–9: 12. international workshop on weak interactions and neutrinos, Ginosar (Israel), 9-14 Apr 1989). Order Number DE90001814. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Recent theoretical and experimental progress on rare decays is summarized, principally for K and B mesons, as discussed in the parallel sessions of this workshop. 51 refs., 6 figs.

3966 (SLAC-PUB–5048) **B physics at the Z^0 pole.** Atwood, W.B.; Mours, B. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Oct 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8906210–4: Workshop on B-factories and related issues, Blois (France), 26 Jun - 1 jul 1989). Order Number DE90001815. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The SLC has been running at SLAC since April, and more than 100 Z^0 events have been reconstructed. Shortly the new European facility at CERN-LEP-will also turn on, and by the end of the year we anticipate that more than 10,000 Z^0 events will have been registered by each of the four LEP detectors. Most of the experimental facilities at these two machines are equipped with excellent particle tracking and identification. Some have close-in tracking devices which will provide unparalleled precision in trajectory reconstruction, and lead to the possibility of identifying a large proportion of the charmed and beauty particles. Not only does the Z^0 pole offer a relatively large production cross section for e^+e^- machines, but a large proportion of the events are $b\bar{b}$ pairs. One sees from this figure that a gain of six or more is obtained from running at the Z^0. An SLC producing 10^5 events per year yields 20,000 $b\bar{b}$ events. Similarly, for LEP, over 200,000 $b\bar{b}$ events will become available per year. In addition, the planned upgrade for LEP will increase its luminosity by about an order of magnitude, and the SLC will run with polarized electron beams. The physics that may be studies from these event samples fall into two general categories: tests of the Standard Model; and studies of B mesons and B baryons, including lifetimes, mixing, spectroscopy, and CP violation. 8 refs., 8 figs., 1 tab.

3967 (SLAC-PUB–5118) **Recent results on weak decays of charmed mesons from the Mark III experiment.** Browder, T.E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). 20 Oct 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8907134–2: 17. SLAC summer institute: physics at the 100 GeV mass scale, Stanford, CA (USA), 10-21 Jul 1989). Order Number DE90001818. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent results from the Mark III experiment on weak decays of charmed mesons are presented. Measurements of the resonant substructure of $D^0 \rightarrow K^-\pi^+\pi^-\pi^+$ decays, the first model independent result on $D_s \rightarrow \phi\pi^+$, as well as limits on $D_s \rightarrow \eta\pi^+$ and $D_s \rightarrow \eta'\pi^+$ are described. The implications of these new results are also discussed. 37 refs., 7 figs., 4 tabs.

3968 **Fermilab fixed-target program.** Dixon, R.L. (Fermi National Accelerator Lab., Batavia, IL (USA)). pp. 503 of Proceedings of the II Mexican school of particles and fields. Lucio, J.L. Zepeda, A World Scientific Pub. Co., Teaneck, NJ (1987). (CONF-8612111–: 2. Mexican school on particles and fields, Cuernavaca (Mexico), 4-12 Dec 1986).

This paper reviews a series of lectures that were given by the author on the Fermilab fixed-target physics program at the Second Mexican School of particles and Fields held in Cuernavaca, Mexico., The emphasis is on recent physics results that have come from the most recent fixed-target run of the TEVATRON which occurred in 1985. There is a brief summary of expected results from that run as well as some results from earlier runs. An attempt is made to summarize the future program at Fermilab and to tabulate the overall program. The physics program at Fermilab has been broken into the following categories: electroweak; decays and CP; heavy quarks; and hard collisions.

3969 **Study of $\omega\omega$ systems produced in 38 GeV/c π^-p collisions.** Alde, D.; Binon, F.G.; Bricman, C.; Donskov, S.V.; Gouanere, M.; Inyakin, A.V.; Kachanov, V.A.; Khaustov, G.V.; Knapp, E.A.; Kulik, A.V.; and others. IHEP-IISN-LANL-LAPP-TSUIHEP Collaboration. *Soviet Journal of Nuclear Physics (English Translation) (USA)*, 49(4): 636 (Apr 1989).

The $\pi^-p \rightarrow \omega\omega n$ reaction has been studied for the first time at the 70 GeV IHEP accelerator. The six photons from the decay of the two ω mesons were detected in GAMS-2000, a hodoscope multiphoton spectrometer. Two resonances decaying into $\omega\omega$,$X(1640)$ and $X(1960)$, have been observed. Their quantum numbers are $J^{PC}=2^{++}$, $I^G=0^+$. The reaction is dominated by the one-pion exchange mechanism. The production cross sections $\sigma \cdot BR$ ($X \rightarrow \omega\omega$) are 0.65 ± 0.15 μb and 1.0 ± 0.2 μb, respectively.

3970 **Search for unstable heavy neutral leptons in e^+e^- annihilations at $\sqrt{s}$ from 50 to 60.8 GeV.** Shaw, N.M. (University of Rochester, Rochester, NY (USA)); Blanis, D.; Bodek, A.; Budd, H.; Coombes, R.; Eno, S.; Fry, C.A.; Harada, H.; Ho, Y.H.; Kim, Y.K.; and others. AMY Collaboration. *Physical Review Letters (USA)*, 63(13): 1342-1345 (25 Sep 1989).

A search for unstable heavy neutral leptons has been made at center-of-mass energies from 50 to 60.8 GeV with the AMY detector at the KEK Storage ring TRISTAN. The neutral leptons are assumed to decay via mixing to electrons and muons. Events with two leptons were searched for. No evidence for their existence was found. Limits in the mass range $7.8 \leq M_{L^0} \leq 28.1$ GeV/c^2 and mixing-parameter range $9 \times 10^{-10} \leq |U_{iL}|^2 \leq 1$ are presented for Dirac- and Majorana-type neutrinos.

3971 **Radiative kaon capture at rest in hydrogen.** Whitehouse, D.A. (Boston University, Boston, MA (USA)); Booth, E.C.; Gall, K.P.; McIntyre, E.K.; Miller, J.P.; Roberts, B.L.; Fickinger, W.J.; Robinson, D.K.; Hasinoff, M.D.; Measday, D.F.; Noble, A.J.; Hessey, N.P.; Lowe, J.; Horvath, D.; Sakitt, M.; Salo *Physical Review Letters (USA)*, 63(13): 1352-1355 (25 Sep 1989).

The photon spectrum from K^- stopping in liquid hydrogen has been measured with a high-resolution (1.5% FWHM at 300 MeV) NaI(Tl) detector. The branching ratios for $K^-p \rightarrow \Lambda\gamma$ (E_γ=281.4 MeV) and $K^-p \rightarrow \Sigma^0\gamma$ (E_γ=219.5 MeV) were obtained. The results are $R_{\Lambda\gamma}=(0.86 \pm 0.07^{+0.10}_{-0.08}) \times 10^{-3}$ and $R_{\Sigma^0\gamma}=(1.44 \pm 0.20^{+0.12}_{-0.10}) \times 10^{-3}$ where the first error is statistical and the second systematic. These results are not in good agreement with published predictions or with previous $\Lambda\gamma$ measurements.

6452 Particle Interactions and Properties - Theoretical

Refer also to citation(s) 3278, 3963, 3965, 4028, 4029, 4030, 4031, 4033, 4047, 4053, 4059, 4061, 4067, 4158, 4167

3972 (ANL-HEP-CP–89-69) **The role of the axial anomaly in determining spin-dependent parton distributions.** Carlitz, R.D.; Collins, J.C.; Mueller, A.H. Argonne National Lab., IL (USA). 27 Jul 1989. 15p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. (CONF-8903175–1: Recontre de Moriond conference, Les Arcs (France), 12-17 Mar 1989). Order Number DE90002226. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

It is shown that the forward matrix elements of j_5^μ, the flavor singlet axial vector current, do not measure the helicity carried by quarks and anti-quarks but also include a spin-dependent gluonic component due to the anomaly. Detailed phenomenological and field theoretic reasons are given for the necessity of a gluonic component in the matrix element of j_5^μ. The first higher order corrections

to the basic box and triangle graphs are discussed and shown not to modify the conclusions drawn in the leading order calculation. We close with a few comments on the possible phenomenological implications of the anomalous contribution. 25 refs., 6 figs.

3973 (ANL-HEP-CP-89-109) **B production in hadron collisions: Theory.** Berger, E.L. Argonne National Lab., IL (USA). 28 Sep 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8906210-3: Workshop on B-factories and related physics issues, Blois (France), 26 Jun - 1 jul 1989). Order Number DE90002205. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A review is presented of heavy quark production in $\bar{p}p$, π^-p, and pp interactions at fixed target and collider energies. Calculations of total cross sections and of single quark inclusive differential cross sections $d^2\sigma/dk_T dy$ are described including contributions through next-to-leading order in QCD perturbation theory. Comparisons with available data on charm and bottom quark production show good agreement for reasonable values of the charm and bottom quark masses and other parameters. Predictions and open issues in the interpretation of results are summarized. 20 refs., 5 figs.

3974 (ANL-HEP-CP-89-112) **Search for supersymmetric particles at CDF.** Wagner, R.G. Argonne National Lab., IL (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8904226-11: 12. international workshop on weak interactions and neutrinos, Ginosar (Israel), 9-14 Apr 1989). Order Number DE90002843. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Analyses of events with large unbalanced transverse energy from the 1987 and 1988-89 CDF data runs have set limits on the masses of supersymmetric squarks and gluinos. In a simple model with a stable photino as the lightest supersymmetric particle, the 1987 data with an integrated luminosity of 25.3 nb^{-1} have excluded at the 90% CL, squarks of mass less than 73 GeV/c^2 and gluinos of mass less than 74 GeV/c^2. Preliminary results from an analysis of 1 pb^{-1} of data from the current 1988-89 run imply that the existence of a squark of mass less than 150 GeV/c^2 is unlikely. 4 refs., 2 fig., 1 tab.

3975 (ANL/PPRNT-89-192) **Pion distribution in the nucleon.** Lee, T.-S.H. Argonne National Lab., IL (USA). 1989. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90003003. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A model is presented for calculating the pion wave function inside the nucleon. By assuming that all pions around a core of the nucleon are in the lowest eigenstate of the system, it is shown that both the bound state and πN scattering amplitude can be consistently described by an exactly soluble model defined in the subspace spanned by the core state and the physical πN state. The parameters of the model are determined by fitting the data of the nucleon mass, πNN coupling constant and low energy πN scattering phase shifts. The model predicts that the probability of finding the pion component inside the nucleon is about 20%. The calculated πNN form factor differs significantly from the conventional monopole form. The dynamical consequences of the differences are demonstrated in a calculation of electromagnetic production of pions from the nucleon and the deuteron. 7 refs., 4 figs., 1 tab.

3976 (CEA-CONF-9796) **Theoretical aspect of J/PSI production in nucleus-nucleus collisions.** Blaizot, J.P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique. 1988. 15p. (CONF-8809203-: Quark Matter '88: 7th international conference on ultrarelativistic nucleus-nucleus collisions, Lenox, MA (USA), 26-30 Sep 1988). Order Number DE90721236. Available from NTIS (US Sales Only), PC A03/MF A01.

A review of various theoretical works on the J/PSI suppression in nucleus-nucleus collisions is given. The suggestion of Matsui and Satz, that Debye screening in a quark-gluon plasma could prevent the binding of a charm quark-antiquark pairs is discussed. Works attempting to explain the observed suppression in terms of absorptions on the secondaries of the collisions are shown. The question whether J/PSI suppression in nucleus-nucleus collisions can be understood in terms of what is observed in hadron nucleus collisions is considered.

3977 (CONF-8907127-3) **Neutral pion photoproduction of the nucleon near threshold.** Nozawa, S.; Lee, T.S.H.; Blankleider, B. Argonne National Lab., IL (USA). 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 12. few body conference; Vancouver (Canada); 2-8 Jul 1989. Order Number DE90002838. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Neutral pion photoproduction on the nucleon near threshold is investigated using a dynamical model. It is shown that the commonly used procedure, based on an analytical continuation of the K-matrix to the unphysical region, is not compatible to a dynamical approach. We show that the final state interaction (FSI) amplitude derived from a dynamical model could involve large cancellation between the different pion photoproduction mechanisms. This leads that the FSI due to the intermediate π^0p state can be as important as that due to the π^+n intermediate state. At threshold, we obtain $E_{0+} = -1.92 \times 10^{-3}/m_{\pi+}$. This number is close to the measured value of $E_{0+} = -1.5 \times 10^{-3}/m_{\pi+}$. No violation of the low energy theorem is required to obtain good agreement between the calculated total cross sections and experimental data drum threshold to about 400 MeV incident photon energy. 10 refs., 4 figs., 3 tabs.

3978 (DOE/ER/03956-T4) **[Elementary particle interactions]: Progress report.** Close, F.E. Tennessee Univ., Knoxville, TN (USA). Dept. of Physics. 1988. 8p. DOE Contract AS05-76ER03956. Order Number DE89004682. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper briefly discusses high energy physics research in inelastic scattering of leptons from hadron and nuclear targets; nuclear dependence of parton distributions; and shadowing of nuclear structure functions. (LSP)

3979 (DOE/ER/40224-90) **Average transverse momentum in the geometrical branching model with jets.** Hwa, R.C.; Wang, Xin-nian. Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science. Sep 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. (CONF-8806260-4: 19. international symposium on multiparticle dynamics - new data and theoretical trends, Arles (France), 13-17 Jun 1988; OITS-397). Order Number DE90003327. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The dependence of the average transverse momentum $\langle p_T \rangle_n$ on multiplicity is investigated in the framework of the geometrical branching model with minijets. A ledge effect in the rise-plateau-rise structure is found. The physical reasons for such an effect are given. 11 refs., 4 figs.

3980 (DOE/ER/40224-91) **Towards a unification of the geometrical, stochastic and dynamical properties of hadronic matter in collision.** Hwa, R.C. Oregon Univ., Eugene, OR (USA). Nov 1988. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. (CONF-8810264-14: Conference on hadronic matter in collision, Tucson, AZ (USA), 6-12 Oct 1988; OITS-400). Order Number DE90003328. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This is a review of the geometrical branching model for multiparticle production in hadron-hadron and hadron-nucleus collisions. Topics included are: KNO scaling and its violation, geometrical scaling and its violation, multiplicity dependence of $\langle p_T \rangle$ due to jet production, and formulation of the hA collision problem that allows the incident hadron to be broken. It is suggested that this model provides a framework in which the geometrical, stochastic and dynamical properties of the soft and semihard production processes can be unified. 22 refs.

3981 (DOE/ER/40224-108) **Intermittency in multiparticle dynamics.** Hwa, R.C. Oregon Univ., Eugene, OR (USA). Dept. of Physics. 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. (OITS-417;CONF-8905208-3: 3. international conference on elastic and diffractive scattering, Evanston, IL (USA), 2-6 May 1989). Order Number DE90003353. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A review is given on the recent studies of multiplicity fluctuations in narrow rapidity windows in multiparticle production processes. Simple models involving sequential branching are given to show how power-law behaviors of appropriate moments can arise. The specific branching model in ϕ^3 theory is discussed in the skeleton form. Questions related to diffractive process are raised. 20 refs.

3982 (DOE/ER/40224–110) **QCD corrections to weak decays.** Deshpande, N.G. Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science. Jun 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. (CONF-8904226–12: 12. international workshop on weak interactions and neutrinos, Ginosar (Israel), 9-14 Apr 1989; OITS–419). Order Number DE90003332. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Weak decays are significantly altered by effects of strong interaction. In the K system these corrections give rise to $\Delta I = 1/2$ rule, and have measurable effects on rare weak process like $K \to \pi\nu\bar{\nu}$, $K \to \pi e^+e^-$ and ε'/ε. The situation in the K system is briefly reviewed. Strong interaction effects are also important in D and B system. A possible mechanism for D^+-D^0 life-time difference is reviewed and then rare B processes are dealt with extensively. Electromagnetic penguin diagrams are enhanced by QCD corrections, giving rise to process like $B \to K^*\gamma$ and $B \to Ke^+e^-$. Process mediated by gluon penguins are also discussed. 24 refs., 8 figs.

3983 (DOE/ER/40224–114) **When is a heavy quark not a parton? Charged Higgs production and heavy quark mass effects in the QCD-based parton model.** Olness, F.I.; Tung, Wu-Ki. Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science. Oct 1989. 16p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG06-85ER40224. (CONF-8905223–2: 12. Warsaw symposium on elementary particle physics, Kazimierz (Poland), 29 May - 2 jun 1989; OITS–426). Order Number DE90003320. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Applications of the QCD-based parton model to new physics processes involving heavy partons are illustrated using charged Higgs production. The naive parton model predictions are found to overestimate the actual cross section by a factor of 2 to 5. The role of the top quark as a "parton" is examined, and the energy range over which heavy quarks (or other particles) should or should not be naturally treated as "partons" is delineated. 12 refs., 5 figs.

3984 (DOE/ER/40389–54) **Status of BNL E791: Study of very rare K_L^0 decays.** McFarlane, W.K. Pennsylvania Univ., Philadelphia, PA (USA). Dept. of Physics. [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40389. (CONF-8904226–10: 12. international workshop on weak interactions and neutrinos, Ginosar (Israel), 9-14 Apr 1989). Order Number DE90002563. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

BNL E791 is a search for the lepton-number non-conserving decay $K_L^0 \to \mu e$. During the 1988 run, the apparatus was also sensitive to the decays $K_L^0 \to \mu\mu$, $K_L^0 \to ee$, and $K_L^0 \to \pi^0 ee$. Preliminary limits on the branching fractions from this run are: $B(K_L^0 \to \mu e) < 3 \times 10^{-10}$ and $B(K_L^0 \to ee) < 3 \times 10^{-10}$. For the decay $K_L^0 \to \mu\mu$, we identified 87 candidate events. We expect to reach a single-event sensitivity in the 10^{-11} range in the future. 10 refs., 3 figs.

3985 (DOE/ER/40427–11-N9) **Neutrino disintegration of deuterium.** Ying, S.; Haxton, W.; Henley, E.M. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-8905187–6: WEIN '89: international symposium on weak and electromagnetic interactions in nuclei, Montreal (Canada), 15-19 May 1989). Order Number DE90003336. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We calculate the rate of both neutral- and charged-current neutrino and antineutrino disintegration of deuterium. These rates are of interest for solar ^8B and hep (^3He + p) spectra and supernovae neutrinos, and are relevant for the Sudbury Neutrino Observatory (SNO).

3986 (FNAL/C–89/232-T) **Status of glueball mass calculations in lattice gauge theory.** Kronfeld, A.S. Fermi National Accelerator Lab., Batavia, IL (USA). Nov 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8909221–2: HADRON '89: 3rd international conference on hadron spectroscopy, Ajaccio (France), 23-27 Sep 1989). Order Number DE90003345. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The status of glueball spectrum calculations in lattice gauge theory is briefly reviewed, with focus on the comparison between Monte Carlo simulations and small-volume analytical calculations in SU(3). The agreement gives confidence that the large-volume Monte Carlo results are accurate, at least in the context of the pure gauge theory. An overview of some of the technical questions, which is aimed at non-experts, serves as an introduction. 19 refs., 1 fig.

3987 (IC–89/74) **On the interactions of charged particles with cosmic string.** Kogan, Ya.I.; Selivanov, K.G. International Centre for Theoretical Physics, Trieste (Italy). May 1989. 16p. Order Number DE90607636. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We discuss the scattering of charged particles on cosmic string. The cases of the small and large (comparing the string scale) momentum of particles are considered. Anisotropical amplitude which describes the action of the string's "magnetic" field on the particles obtained. Physical applications are briefly discussed. (author). 8 refs, 2 figs.

3988 (IC–89/141) **Composite scalar mesons in QCD.** Bodyulkov, A.; Novozhilov, V. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 10p. Order Number DE90607607. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The effective Lagrangian is derived by the bosonization method to describe the low-lying scalar mesons in the QCD low-energy region. The mass spectra and two-photon width $\Gamma(f_0(975) \to \gamma\gamma) = 0.17$ KeV are in good agreement with the experiment. (author). 19 refs, 1 tab.

3989 (IC–89/178) **Polarization asymmetries of large P_t leptons at hadron colliders in E_6 theories.** Pankov, A.A.; Satsunkevich, I.S. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 21p. Order Number DE90607608. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Possible observation of P-odd asymmetries initiated by extra superstring Z' bosons in longitudinally polarized hadronic collision with inclusive production of high-mass dileptons with large transverse momentum is studied in the QCD lowest order. The polarized asymmetry and polarized forward-backward one of lepton are numerically estimated for various E_6 models. These asymmetries can be used to probe the couplings of a new Z' boson. Results are presented for the present pp-bar colliders at CERN and FERMILAB. (author). 20 refs, 8 figs.

3990 (IC–89/196) **Renormalization scheme dependence in the next-to-next-to-leading order and the high energy behaviour in QCD.** Raczka, P.A.; Raczka, R. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 13p. Order Number DE90607635. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

It is pointed out that the renormalization scheme dependence of the next-to-next-to-leading order predictions for observable quantities in QCD is very strong. For example, formally one may always find a scheme, in which the predicted energy dependence is different from that implied by the asymptotic freedom. Therefore any conclusions obtained in one chosen fixed renormalization scheme - for example MS-bar - are of a limited scientific value. (author). 19 refs, 3 figs.

3991 (INIS-BR–1706) **Study of Angra I reactor core with inserted control rods.** Pina, C.M. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1981. 42p. (In Portuguese). Order Number DE90607581. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The Angra 1 reactor core with inserted control rods is calculated using computer codes.

3992 (INIS-mf–12007) **Beam propagation.** Hermansson, B.R. Lund Univ. (Sweden). 27 Feb 1989. 19p. Order Number

DE90718756. Available from NTIS (US Sales Only), PC A03/MF A01.

The main part of this thesis consists of 15 published papers, in which the numerical Beam Propagating Method (BPM) is investigated, verified and used in a number of applications. In the introduction a derivation of the nonlinear Schroedinger equation is presented to connect the beginning of the soliton papers with Maxwell's equations including a nonlinear polarization. This thesis focuses on the wide use of the BPM for numerical simulations of propagating light and particle beams through different types of structures such as waveguides, fibers, tapers, Y-junctions, laser arrays and crystalline solids. We verify the BPM in the above listed problems against other numerical methods for example the Finite-element Method, perturbation methods and Runge-Kutta integration. Further, the BPM is shown to be a simple and effective way to numerically set up the Green's function in matrix form for periodic structures. The Green's function matrix can then be diagonalized with matrix methods yielding the eigensolutions of the structure. The BPM inherent transverse periodicity can be untied, if desired, by for example including an absorptive refractive index at the computational window edges. The interaction of two first-order soliton pulses is strongly dependent on the phase relationship between the individual solitons. When optical phase shift keying is used in coherent one-carrier wavelength communication, the fiber attenuation will suppress or delay the nonlinear instability. (orig.).

3993 (INIS-mf–12013, pp. 127) **Rapidity distribution and scaling violation in a statistical approach to string fragmentation.** Aichelin, J.; Huefner, J.; Kurihara, Y. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. MULTIPLE PRODUCTION/statistical models; ELECTRON-POSITRON INTERACTIONS/annihilation; MUON-PROTON INTERACTIONS/deep inelastic scattering; SCALE INVARIANCE; PHASE SPACE; STRING MODELS; LIMITING FRAGMENTATION; ANNIHILATION; PARTICLE RAPIDITY; HADRONS; SYMMETRY BREAKING

3994 (INIS-mf–12013, pp. 127) **Multiplicity distribution of particles from string fragmentation calculated in a statistical model.** Kurihara, Y.; Huefner, J.; Aichelin, J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. MULTIPLE PRODUCTION/statistical models; ELECTRON-POSITRON INTERACTIONS/annihilation; MUON-PROTON INTERACTIONS/deep inelastic scattering; STRING MODELS; LIMITING FRAGMENTATION; MULTIPLICITY; ANNIHILATION; PARTICLE RAPIDITY; HADRONS

3995 (INIS-mf–12013, pp. 127-128) **Jet production and decay in relativistic pp collisions.** Schulze, H.J.; Aichelin, J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. PROTON-PROTON INTERACTIONS/multiple production; JET MODEL/proton-proton interactions; RELATIVISTIC RANGE; MONTE CARLO METHOD; LIMITING FRAGMENTATION; STRUCTURE FUNCTIONS; HADRONS; PARTICLE STRUCTURE; PARTON MODEL; MULTIPLICITY; COMPUTERIZED SIMULATION

3996 (INIS-mf–12013, pp. 128) **Discretized light-cone quantization: The massless and the massive Schwinger model.** Eller, T. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Pauli, H.C.; Brodsky, S.J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. SCHWINGER-TOMONAGA FORMALISM/second quantization; ONE-DIMENSIONAL CALCULATIONS; TWO-DIMENSIONAL CALCULATIONS; LIGHT CONE; MASS SPECTRA; REST MASS; BOUND STATE; EIGENVALUES; EIGENFUNCTIONS; HAMILTONIANS; MASSLESS PARTICLES; FERMIONS

3997 (INIS-mf–12013, pp. 128) **Soliton baryons and Goldstone mesons in the cell model of the QCD vacuum.** Klabucar, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. QUANTUM CHROMODYNAMICS/vacuum states; BARYONS/quark model; QUARK MODEL/solitons; GOLDSTONE BOSONS; BARYONS; PSEUDOSCALAR MESONS; ONE-DIMENSIONAL CALCULATIONS; TWO-DIMENSIONAL CALCULATIONS; SPACE-TIME; SOLITONS; QUARKS; PARTICLE STRUCTURE

3998 (INIS-mf–12013, pp. 128-129) **Quark-mass dependence of the chiral model parameters.** Hansson, T.H.; Klabucar, D.; Zahed, I. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. QUARK MODEL/chirality; PIONS/particle structure; COLLECTIVE EXCITATIONS; VACUUM STATES; BOSE-EINSTEIN CONDENSATION; GLUEBALLS; CHIRALITY; WEAK PARTICLE DECAY; REST MASS; KAONS; PIONS; QUARKS; COUPLING CONSTANTS

3999 (INIS-mf–12013, pp. 129) **Phenomenological hadron form factors and finite size of chiral solitons.** Klabucar, D. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)). Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. BAG MODEL/solitons; HADRONS/form factors; CHIRALITY; PARTICLE STRUCTURE; SOLITONS; PARTICLE RADII; OMEGA-783 MESONS; RENORMALIZATION; VECTOR FIELDS; MESON-NUCLEON INTERACTIONS; NUCLEONS; OBE MODEL; HADRONS

4000 (INIS-mf–12013, pp. 129) **How does one see QCD degrees of freedom in physics of interacting hadrons?.** Pirner, H.J.; Wroldsen, J.; Ilgenfritz, M. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The derivation of the quark confinement in the color-dielectric picture is made using lattice gauge theory. The NN vector annihilation is studied in the quark rearrangement model. Effects of soft gluons influence the Drell-Yan production of dilepton pairs in nuclei. (orig.).

4001 (INIS-mf–12013, pp. 129-130) **Nanti N-interaction.** Pirner, H.J.; Ihle, G.; Richard, J.M. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. QUARK MODEL/nucleon-antinucleon interactions; NUCLEON-ANTINUCLEON INTERACTIONS/annihilation; BRANCHING RATIO; HAMILTONIANS; P WAVES; S WAVES; QUARK-ANTIQUARK INTERACTIONS; ANNIHILATION; PROTON-ANTIPROTON INTERACTIONS; MESONS; VARIATIONAL METHODS; GENERATOR-COORDINATE METHOD; MANY-BODY PROBLEM; SCHROEDINGER EQUATION; POTENTIAL SCATTERING; CORRECTIONS; RELATIVISTIC RANGE; ENERGY DEPENDENCE; POTENTIALS; WAVE FUNCTIONS; THREE-BODY PROBLEM; QUANTUM CHROMODYNAMICS; PAIR PRODUCTION

4002 (INS–757) **Super-hypernuclei in the quark-shell model, 2.** Terazawa, Hidezumi. Tokyo Univ., Tanashi (Japan). Inst.

for Nuclear Study. Jul 1989. 15p. Order Number DE90719577. Available from NTIS (US Sales Only), PC A03/MF A01.

By following the previous paper, where the quark-shell model of nuclei in quantum chromodynamics is briefly reviewed, a short review of the MIT bag model of nuclei is presented for comparison and a simple estimate of the Hλ ('hexalambda') mass is also made for illustration. Furthermore, an even shorter review of the 'nucleon cluster model' of nuclei is presented for further comparison. (J.P.N.).

4003 (IPNO-TH–88-61) **High density matter state equation and phase transitions.** Vautherin, D. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Sep 1988. 50p. (In French). Order Number DE90721242. Available from NTIS (US Sales Only), PC A03/MF A01.

The models and methods applied to quark and gluon plasmas are studied. Statistical-mechanics equations concerning density operator, entropy, equilibrium-distribution partition functions, free fermions and ensemble equivalences are reviewed. The nuclear-matter thermal-properties calculation and experimental data are shown. The quark-matter properties, at finite-density and finite-temperature conditions, are calculated by means of Nambu and Jona-Lasinio model.

4004 (JYFL-RR–1/1989) **Hydrodynamics in high-energy nuclear collisions. Quarterly report 3. quarter 1987.** Kataja, Markku. Jyvaeskylae Univ. (Finland). Dept. of Physics. May 1989. 48p. Order Number DE90607609. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This thesis is a review of six publications in which we make use of relativistic hydrodynamics to solve the evolution of matter produced in extremely energetic nucleus-nucleus collisions. In the first one of these papers we study the thermodynamics, the hydrodynamics and the decoupling conditions of such matter. We discuss the initial conditions for the flow, the hydrodynamic equations for the transverse expansion of matter assuming cylindrical symmetry and longitudinal boost invariance and finally present a numeric algorithm, which we use to integrate these equations. In the subsequent three papers this framework is utilized to calculate the transverse momentum spectra of hadrons, the dilepon production and the abundance of strange particles in the final state. The bag model equation of state is used to simulate the first-order phase transition between baryonless hadronic matter and quark-gluon plasma. In the fifth paper we include the particle production from decaying color electric field according to the flux tube model for heavy ion collisions. The hadronization is incorporated by introducing an equilibrium 'mixed state' of hadrons gas, plasma and the color field in analogy to the mixed phase described by the ordinary bag model equation of state. In the last paper I apply a 1+2 dimensional numeric code to analyze a 1+3 dimensional cylindrically symmetric flow of matter assumed to be formed in a central O+Pb collision at 200 GeV/nucleon. The flow data is used to calculte the pseudorapidity distribution of transverse energy for the produced pions.

4005 **Finite temperature QCD with four light quark flavours.** Sinclair, D.K. (Argonne National Lab., IL (USA). High Energy Physics Div.); Kogut, J.B. *Physics Letters [Section] B (Netherlands)*, 229(1/2): 93-96 (5 Oct 1989). DOE Contract W-31-109-ENG-38. PHY-87-01775.

QCD with four light flavours of dynamical staggered quarks (m=0.025 lattice units) was simulated on a 12^3x4 lattice using the hybrid algorithm. We found clear evidence for a first order transition to a quark-gluon plasma. This is in agreement with simulations on smaller lattices (up to 8^3x4). This contrasts with the intermediate mass range (m> or approx.0.1) where transitions seen on smaller lattices appear to be a finite size effect rather than true first order transitions. (orig.).

4006 **What is the order of the transition from hadronic matter to the quark-gluon plasma?.** Kogut, J.B. (Illinois Univ., Urbana (USA). Dept. of Physics); Sinclair, D.K. *Physics Letters [Section] B (Netherlands)*, 229(1/2): 107-111 (5 Oct 1989). DOE Contract W-31-109-ENG-38.

Simulations of SU(3) gauge theory with a realistic spectrum of quarks are done on a 4x12^3 lattice. Comparing with similar simulations on a 4x8^3 lattice, we find a narrower region of metastability at the hadronic matter/quark-gluon plasma phase transition. Tunneling events are observed and discontinuities in order parameters and energy densities are measured which are in good agreement with the 4x8^3 results. A decisive determination of the order of the transition will require larger lattices, higher statistics and a finite-size analysis. (orig.).

4007 **Can $\theta_{QCD}=\pi$?.** Cline, J.M. (Department of Physics, The Ohio State University, Columbus, Ohio 43210 (US)). *Physical Review Letters (USA)*, 63(13): 1338-1341 (25 Sep 1989).

Recent work suggests that wormholes in spacetime may drive θ_{QCD} to π, and it has been argued that this is not in conflict with any observations. We have therefore determined current-mass ratios of the light quarks in second-order chiral perturbation theory, with attention to the relative sign of the up-quark mass. We discuss an ambiguity which makes it impossible to determine the quark mass ratios from chiral-Lagrangian considerations alone. Using results from lattice QCD we resolve the ambiguity to obtain $m_u/m_d=0.61\pm0.26$, $m_s/m_d=21\pm2$, implying that $\theta_{QCD}=0$.

4008 **Contribution of two-pion annihilation to dilepton emission from proton-nucleon collisions.** Kapusta, J. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455 (US)); Lichard, P. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(4): 1574-1576 (Oct 1989).

The Dilepton Spectrometer collaboration has reported a bump in the e^+e^- mass distribution at around $2m_\pi$ in 4.9 GeV proton-Be collisions. Previous calculations have shown that this bump does not have its origin in nucleon-nucleon bremsstrahlung nor in the Dalitz decay of the Δ resonance. In this paper we estimate the contribution from two-pion annihilation based on relativistic kinetic theory, on the experimentally measured cross sections for the production of up to five pions, and on a phase space generator for the pion momentum distributions. The calculation fails to reproduce the data.. The origin of the bump remains unexplained.

4009 **Sewing relations and duality for BRST off-shell string tadpole amplitudes.** Ordonez, C.R. (Theory Group, The Rockefeller University, New York, New York 10021 (US)); Rey, S.; Rubin, M.A.; Zucchini, R. *Physical Review [Section] D: Particles and Fields (USA)*, 40(6): 1987-1992 (15 Sep 1989).

Using a Becchi-Rouet-Stora-Tyutin- (BRST-)invariant first-quantized formalism for closed-bosonic-string theory, we construct amplitudes for closed-string tadpoles in the conformal gauge and discuss the connection with covariant string field theory in the Siegel gauge. We also show that the application of the sewing rules, previously found for propagators, to pairs of these tadpole amplitudes yields the Klein-bottle and annulus one-loop vacuum amplitudes as required by duality and factorization.

4010 **Heavy-Majorana-neutrino production.** Ma, E. (Department of Physics, University of California, Riverside, California 92521 (US)); Pantaleone, J. *Physical Review [Section] D: Particles and Fields (USA)*, 40(7): 2172-2176 (1 Oct 1989).

Heavy-Majorana-neutrino production and detection at colliders is examined. Majorana-neutrino decay is shown to be simply calculable from Dirac-neutrino results. Majorana-neutrino production $f\bar{f}\to Z\to N\bar{N}$ is calculated and compared to Dirac-neutrino production. Near the threshold, the Dirac cross section rises much more quickly. Far above the threshold, the two types of neutrinos have the same spin-independent cross sections while the spin-dependent cross sections are very different. This difference could be observed in the correlations between the angle and energy dependence of the heavy-neutrino decay products.

4011 **One-jet inclusive cross section at order α_s^3. I. Gluons only.** Ellis, S.D. (Department of Physics, University of Washington, Seattle, Washington 98195 (US)); Kunszt, Z.; Soper, D.E. *Physical Review [Section] D: Particles and Fields (USA)*, 40(7): 2188-2222 (1 Oct 1989).

The next-to-leading-order jet cross section is calculated for the simplified case in which there are only gluons. Numerical results of this calculation have been presented elsewhere. Here, we describe the calculational method in some detail, deriving all of the formulas that are necessary for the numerical evaluation of the cross section. The calculation is based on the matrix elements of Ellis and Sexton.

In a future paper, we will extend the calculation to include quarks as well as gluons. When quarks are included, the algebraic complexity of the problem increases substantially. However, the method to be applied is essentially the same as in the gluon-only case, since there are no new singularities in the amplitudes that are not present in the gluon-only amplitudes.

4012 **How to study longitudinal *W*'s in the TeV region.** Kane, G.L. (Randall Physics Laboratory, University of Michigan, Ann Arbor, Michigan 48109 (US)); Yuan, C. *Physical Review [Section] D: Particles and Fields (USA),* 40(7): 2231-2244 (1 Oct 1989).

Using some new techniques we examine ways to experimentally study interactions of longitudinal *W* bosons in the TeV region, and to detect a heavy Higgs boson (mass $\geq$1 TeV) if it exists. This is a problem that must be solved if we are eventually to fully understand and test how the SU(2)×U(1) symmetry of the standard model is broken. To do so at a hadron collider requires methods to discriminate against large backgrounds. We use a new method based on the color properties of the signal and background, leading to a multiplicity cut, and we use analysis techniques that do not reduce the signal events by strong cuts. Our techniques do not bias *W* decay distributions and we conclude that it is possible to detect longitudinal *W*'s even in the presence of background. Results are given for how it is possible to study these matters at the Superconducting Super Collider. The use of the "equivalence theorem" between longitudinal *W*'s and Goldstone scalars is examined in several ways; in particular, we emphasize that in practice the equivalence does not hold numerically when the widths of heavy resonances are included in the traditional way, i.e., using the Breit-Wigner prescription. The violations are numerically large.

4013 **Weak decays of *K* and π mesons.** Galic, H. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(7): 2279-2289 (1 Oct 1989). DOE Contract AC03-76SF00515.

Through a special interplay of strong and weak interactions, small but significant pieces with a "wrong" flavor could be introduced into wave functions of mesons. Thus, e.g., not only a ($u\bar{s}$) pair, but also a ($u\bar{d}$) pair can be found with some probability within K^+, etc. The possible importance of such "anomalous" terms in understanding of *K*-meson decays is discussed in a new scheme. The scheme is characterized by diagrammatic calculations of full amplitudes in the long-distance environment. Two classes of models which correctly reproduce the main *K*-meson branching ratios and the ΔI=1/2 rule are constructed. The predictive power of the scheme is then tested in a decay of a kaon into a pion and a light hyperphoton.

4014 ***Z*-boson bremsstrahlung in heavy-quark decay.** Barger, V. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706 (US)); Keung, W.; Rizzo, T.G. *Physical Review [Section] D: Particles and Fields (USA),* 40(7): 2274-2278 (1 Oct 1989). DOE Contract AC02-76ER00881.

We calculate the rate for *Z*-boson bremsstrahlung in the charged-current decay $Q \rightarrow qWZ$ of a heavy fermion *Q* to a light fermion *q*. This process may be used to test the *WWZ* trilinear gauge-boson coupling of the standard model. We evaluate the branching fraction for this decay mode of fourth-generation and E_6 exotic fermions; the branching fraction increases dramatically with increasing m_Q and may reach 1% for TeV fermion masses.

4015 **Flavor-changing decays of the Z^0 and leptoquarks.** Doncheski, M.A. (Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802 (US)); Grotch, H.; Robinett, R.W.; Schilcher, K.; Belanger, G.; Moxhay, P. *Physical Review [Section] D: Particles and Fields (USA),* 40(7): 2301-2304 (1 Oct 1989).

Many extensions of the standard model, e.g., certain composite models and some superstring-"inspired" E_6 models, contain new scalar matter fields which couple to both quarks and leptons, i.e., leptoquarks. We consider leptonic flavor-changing decays of the Z^0, e.g., $Z^0 \rightarrow \mu^+\tau^-$, due to one-loop diagrams involving such leptoquarks. We find branching ratios which are at most $\approx 10^{-7}$, even assuming generous values for unknown Yukawa couplings.

4016 **Pair production from photon-pulse collisions.** Blankenbecler, R. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309 (US)); Drell, S.D.; Kroll, N. *Physical Review [Section] D: Particles and Fields (USA),* 40(7): 2462-2476 (1 Oct 1989). DOE Contract AC03-76SF00515.

The high-energy expansion for extended targets developed previously is used to describe the problem of electron pair production by photons, a problem of interest in linear-collider design. The treatment is valid throughout the range of possible parameters, from the classical regime to the extreme quantum domain. The relation between this process and pair production in a constant external field is discussed.

6453 Particle Invariance Principles and Symmetries

Refer also to citation(s) 3968, 4015, 4047, 4055, 4061, 4127

4017 (DOE/ER/40224–115) **Left-right symmetric electroweak models.** Olness, F.I. Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science. Oct 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. (CONF-8905223–3: 12. Warsaw symposium on elementary particle physics, Kazimierz (Poland), 29 May - 2 jun 1989). Order Number DE90003323. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We present a critical analysis of the spontaneous symmetry breaking and the Higgs sector of the conventional $SU(2)_L \otimes SU(2)_R \otimes U(1)_{B-L}$ left-right symmetric theory involving bi-doublet and triplet Higgs fields. We examine the phenomenological constraints imposed on the minimization of the Higgs potential arising from experimental observations, and explore the resulting consequences including the problem of "fine- tuning" arising from the hierarchy of mass scales involved. We show that it is non-trivial to satisfy all of these constraints. We contrast the benefits of this general class left-right models against the required "fine-tuning" necessary to force the phenomenology to conform to experimental fact. 17 refs., 1 fig.

4018 (DOE/ER/40427–13-N9) **Status of time reversal invariance.** Henley, E.M. Washington Univ., Seattle, WA (USA). Dept. of Physics. 1989. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-8905187–8: WEIN '89: international symposium on weak and electromagnetic interactions in nuclei, Montreal (Canada), 15-19 May 1989). Order Number DE90003350. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Time Reversal Invariance is introduced, and theories for its violation are reviewed. The present experimental and theoretical status of Time Reversal Invariance and tests thereof will be presented. Possible future tests will be discussed. 30 refs., 2 figs., 1 tab.

4019 (DOE/ER/40427–14-N9) **Chiral symmetry restoration and quasi-elastic electron-nucleus scattering.** Henley, E.M.; Krein, G. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-8905187–7: WEIN '89: international symposium on weak and electromagnetic interactions in nuclei, Montreal (Canada), 15-19 May 1989). Order Number DE90003349. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Chiral symmetry is known to be an important concept in hadronic interactions. It holds in QCD, but is known to be broken at low energies. It is therefore useful to study chiral symmetry and its breaking together with its consequences in nuclear physics. It is the latter phenomena we consider here. It is difficult to study nonperturbative QCD at low energies and models are needed. The Nambu-Jona-Lasinio (NJL) model fits this category; it incorporates chiral symmetry and its breaking, and allows one to study its effects in nucleons and nuclei. In particular, the constituent quark mass varied with density (ρ) and temperature (T). At high ρ and T chiral symmetry is restored. It is the ρ dependence which yields important effects in electron scattering due to partial restoration of chiral symmetry in nuclei. 4 refs., 2 figs.

4020 (INS–754) **Double-periodic wormholes in theories with global symmetries.** Midorikawa, Shoichi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jun 1989. 12p. Order Number

DE90719575. Available from NTIS (US Sales Only), PC A03/MF A01.

We examine the quantum theory of a complex scalar field with global U(1) symmetry minimally coupled to gravity. We find numerically that there exists a double-periodic wormhole solution in addition to a single-periodic one if a potential has a local maximum at a finite value of the scalar field. Spontaneous breakdown of the U(1) symmetry is irrelevant to the existence of the wormholes of finite action. (author).

4021 (INS–755) **Degenerate fermion and Wilson loop in 1+1 dimensions.** Shiraishi, K. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jul 1989. 16p. Order Number DE90719576. Available from NTIS (US Sales Only), PC A03/MF A01.

We investigate the effect of finite fermion density on symmetry breaking by Wilson loops in (1+1) dimensions. We find breaking and restoration of symmetry at finite density in the models with SU(2) and SU(3) gauge symmetries and adjoint fermions. It is shown that the transition can occur even if the boundary condition of the fermion field is set to a periodic or an antiperiodic one; it is contrary to the finite-temperature case examined by Ho and Hosotani, where the boundary condition of fractional twist is necessary for the occurrence of the phase transition. (author).

4022 (INS–756) **Estimation of the one-loop mass shifts in open superstring theory.** Nishioka, Tsuyoshi; Tsuchiya, Akihiko; Yamamoto, Hisashi. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jul 1989. 15p. Order Number DE90719578. Available from NTIS (US Sales Only), PC A03/MF A01.

The quantitative studies of the one-loop mass shifts for the first excited states in ten-dimensional open superstring are given. Removing the apparent singularities in the on-shell integral expressions by an off-shell analytic continuation, we obtain the finite mass shifts with imaginary parts. We numerically evaluate the real part to find the smallness of the magnitude of one-loop effect. (author).

4023 (LBL–27452) **Tests of time reversal invariance via transmission experiments.** Conzett, H.E. Lawrence Berkeley Lab., CA (USA). Jun 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8906235–1: Symposium on spin and symmetries, Vancouver (Canada), 30 Jun - 2 jul 1989). Order Number DE90002121. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The existing formalism used to describe spin observables in neutron transmission experiments is found to be inadequate. A suitable formalism is developed, through which time-reversal violating (and parity non-conserving) forward scattering amplitudes are identified, along with their corresponding spin observables. It is noted that new and more precise tests of T-symmetry are provided in transmission experiments and that such investigations are applicable more generally in nuclear and particle physics.

4024 (RAL–89-077) **90-GeV Higgs boson in supersymmetric models.** Grzadkowski, B.; Kalinowski, J.; Pokorski, S. Rutherford Appleton Lab., Chilton (UK). Jul 1989. 11p. Sponsored by U.K. Science and Engineering Research Council. (CONF-8905223–4: 12. Warsaw symposium on elementary particle physics, Kazimierz (Poland), 29 May - 2 jun 1989). Order Number DE90000521. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

We discuss supersymmetric models with a hierarchy of vacuum expectation values of Higgs fields. These models predict one of the physical neutral Higgs bosons to have its mass very close to the Z-boson mass. Properties of such a 90-GeV Higgs boson are discussed. 16 refs., 4 figs.

4025 **N=2 superconformal symmetry and SO(2,1) current algebra.** Dixon, L.J. (Stanford Linear Accelerator Center, CA (USA)); Peskin, M.E.; Lykken, J. *Nuclear Physics [Section] B (Netherlands)*, 325(2): 329-355 (16 Oct 1989). DOE Contract AC03-76SF00515;AM03-76SF00010.

We demonstrate that all unitary representations of the N=2 superconformal algebra (for $c>3$) may be obtained from representations of SO(2,1) current algebra by subtracting and then adding back a free boson. This construction gives insight into the unitarity domains for N=2 representations. It may also have a deeper structural significance. (orig.).

4026 **Fuchsian differential equations for characters on the torus: A classification.** Kiritsis, E.B. (California Univ., Berkeley (USA). Dept. of Physics). *Nuclear Physics [Section] B (Netherlands)*, 324(2): 475-494 (25 Sep 1989). DOE Contract AC03-76SF00098.

Fuchsian differential equations for characters of rational conformal field theories on the torus are classified by invoking the solution of the Riemann-Hilbert problem and modular geometry. As a first application, all rational conformal field theories with two characters are classified. (orig.).

4027 **Further study of global gauge anomalies of simple groups.** Okubo, S. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627 (US)); Tosa, Y. *Physical Review [Section] D: Particles and Fields (USA)*, 40(6): 1925-1933 (15 Sep 1989).

We generalize results of our previous studies for global gauge anomalies of simple Lie groups in even-dimensional space $D=2n$. Assuming the absence of local anomalies, we first show that any real (or orthogonal) representation has no global anomaly in $D==2,4,6$ (mod 8), and that the pseudoreal (or symplectic) one is free of global anomalies in $D==0,2,6$ (mod 8). Second, we prove that the SU(3) group has no global anomalies in any even dimension and neither does SU(4) in $D==4$ (mod 8).

4028 **Possible test of *CPT* invariance in neutral-kaon regeneration.** Briere, R.A. (Enrico Fermi Institute and Department of Physics, University of Chicago, Chicago, Illinois 60637 (US)); Orr, L.H. *Physical Review [Section] D: Particles and Fields (USA)*, 40(7): 2269-2273 (1 Oct 1989).

The possibility of *CPT* violation in the K^0-$\bar{K}0$ mass matrix is considered. Limits on this type of *CPT* violation derivable from existing data are discussed. Following a suggestion by Sachs, it is shown that such a violation manifests itself in the regeneration phenomenon. An experimental scenario for obtaining a direct limit using regeneration is presented.

4029 **Screening of large supersymmetry breaking in low-energy physics.** Gunion, J.F. (Department of Physics, University of California, Davis, California 95616 (US)); Turski, A. *Physical Review [Section] D: Particles and Fields (USA)*, 40(7): 2325-2332 (1 Oct 1989).

We consider a supersymmetric theory in which there is a large difference of mass scales between the low-energy sector and the heavy supersymmetric sector that derives from bilinear soft-supersymmetry-breaking terms. We demonstrate that in such a theory "natural" relations, predicted by supersymmetry, between low-energy-physics parameters receive corrections from loops involving the heavy sector particles that grow logarithmically with the heavy-mass scale. Since *a priori*, such corrections might have grown quadratically with the heavy-mass scale, we see that low-energy physics is screened against large corrections. However, we also point out that natural low-energy relations will receive (large) quadratic corrections if there are large trilinear soft-supersymmetry-breaking terms.

4030 **Corrections to Higgs-boson-mass sum rules from the sfermion sector of a supersymmetric model.** Gunion, J.F. (Department of Physics, University of California, Davis, California 95616 (US)); Turski, A. *Physical Review [Section] D: Particles and Fields (USA)*, 40(7): 2333-2339 (1 Oct 1989).

We consider the minimal supersymmetric extension of the standard model, and compute the corrections to Higgs-boson-mass sum rules that are possibly sensitive to the large mass of the sfermion sector and/or to large trilinear Higgs-boson–sfermion–sfermion Yukawa couplings. We demonstrate that when the parameters are chosen so that corrections to the electroweak ρ are within experimental limits, large corrections to the mass sum rules arise only in certain extreme regions of parameter space, corresponding to very large ratios for squark masses.

4031 **Low-energy lepton violation from supersymmetric flipped SU(5).** Brahm, D.E. (Physics Department, University of California, Berkeley, California 94720 (US)); Hall, L.J. *Physical Review [Section] D: Particles and Fields (USA)*, 40(7): 2449-2456 (1 Oct 1989). DOE Contract AC03-76SF00098.

We construct a supersymmetric flipped SU(5)⊗U(1) model which violates *R* parity and electron number at low energies, through a superpotential term ($1/2C^{ijk}L_iL_jE_k^c$). Rotation of the electron and Higgs superfields makes this term also responsible for charged-lepton masses. The model employs a missing-partners mechanism for the Higgs fields and a seesaw mechanism for the neutrinos. It correctly predicts the approximate electron mass and several mass relations, as well as numerical values for the grand unification scale and the C^{ijk} coefficients. The electron-neutrino Majorana mass is close to experimental limits, and provides constraints. Interesting Z^0 decays are predicted: e.g., $Z^0 \rightarrow e^- \mu^+ e^+ \mu^-$ with invariant-mass peaks in the (e,μ) channels.

6454 Field Theory

Refer also to citation(s) 3879, 3986, 4007, 4009, 4011, 4014, 4015

4032 (CTA-IEAv-RP–018/85) **SU(4) proprerties of the Dirac equation.** Linhares, C.A.; Mignaco, J.A. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Sep 1985. 46p. Order Number DE90607090. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The Dirac equation in four dimensions has an intimate connection with the representations of the group SU(4). This connection is shown in detail and subsequent properties are displayed in the continuum as well as in the lattice description.

4033 (DOE/ER/40273–4) **Research in theoretical physics: Technical progress report.** Robson, D. Florida State Univ., Tallahassee, FL (USA). Dept. of Physics. [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER40273. Order Number DE90002539. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses Hamiltonian Lattice Gauge Theory and hadronic models.

4034 (FNAL/C–89/163-T) **Quantum groups, braiding matrices and coset models.** Itoyama, H. Fermi National Accelerator Lab., Batavia, IL (USA). Jul 1989. 17p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC02-76CH03000. (CONF-8907140–3: 18. international conference on differential geometric methods in theoretical physics: physics and geometry, Tahoe City, CA (USA), 2-8 Jul 1989; ITP-SB–89-56). Order Number DE90002110. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We discuss a few results on quantum groups in the context of rational conformal field theory with underlying affine Lie algebras. A vertex-height correspondence - a well-known procedure in solvable lattice models - is introduced in the WZW theory. This leads to a new definition of chiral vertex operator in which the zero mode is given by the q-Clebsch Gordan coefficients. Braiding matrices of coset models are found to factorize into those of the WZW theories. We briefly discuss the construction of the generators of the universal enveloping algebra in Toda field theories. 21 refs., 2 figs.

4035 (IC–89/115) **Simultaneous creation of electron-positron pairs and photons in Robertson-Walker universes with statically bounded expansion.** Lotze, K.H. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 27p. Order Number DE90607091. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Based upon quantum electrodynamics in Robertson-Walker flat universes we present a thorough analysis of the creation of mutually interacting electron-positron pairs and photons from vacuum. Therefore we discuss at least qualitatively all processes contributing to the number densities of created particles up to the second order in the coupling constant. For two particular expansion laws with Winkowskian in resp. in and out regions we obtain exact solutions of the Dirac equation and investigate in detail the process of simultaneous creation of electron-positron pairs and photons and the related attenuation effect for fermionic particles. This is done for electrons and positrons which have non-relativistic momenta at Compton time in rapidly expanding universes. The results are compared with the zeroth-order creation of electron-positron pairs. Despite being smaller by a factor of roughly $e_0^2/4\pi$ approx. 1/137, the interacting-particle creation is important mainly as a source of photons even in conformally flat universes. (author). 16 refs, 7 figs, 1 tab.

4036 (IC–89/145) **Level-one SU(3) Wess-Zumino model on higher genus Riemann surfaces.** Kaul, R.K.; Malik, R.P.; Behra, N. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 13p. Order Number DE90607092. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Partition function and two-point correlator for level-one SU(3) Wess-Zumino model on an arbitrary genus Riemann surface have been obtained. (author). 12 refs, 3 figs.

4037 (IC–89/160) **Vortex-like and string-like solutions for the 2+1 dimensional SU(2) Yang-Mills theory with the Chern-Simons term.** Teh, R. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 11p. Order Number DE90607093. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Vortex-like and string-like solutions of 2+1 Dim. SU(2) YM theory with the Chern-Simons term are discussed. Two ansatze are constructed which yield respectively analytic Bessel function solutions and elliptic function solutions. The Bessel function solutions are vortex-like and tend to the same vacuum state as the Ginzburg-Landau vortex solution at large rho. The Jacobi elliptic function solutions are string-like, have finite energy and magnetic flux concentrated along a line in the x_1 - x_2 plane. (author). 18 refs.

4038 (IC–89/168) **Solution of a class of conformal quantum field theory models in D-dimensional space.** Fradkin, E.S.; Palchik, M.Ya. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 26p. Order Number DE90607094. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Proposed is a method of solving a class of conformal quantum field theory models in D-dimensional Euclidean space-time. Some of the models are determined by regularized field equations. The method allows us to obtain closed differential equations for each Green function of fundamental and composite fields, and also algebraic equations for scale dimensions of fields. Each D>2-model involves an analogue of the central charge, i.e. a special scalar field P of dimension d_P=D-2. When D=2 this field turns into a constant. We also obtain a new class of D=2 models with broken infinite parameter symmetry. Closed differential equation for Green functions of these models are found. As an illustration of how the method works, we derive in the Appendix solutions of the Thirring and Wess-Zumino-Witten models and the two-dimensional Ising model. (author). 13 refs.

4039 (IC–89/173) **Cubic interaction in conformal theory of integer higher-spin fields in four dimensional space-time.** Fradkin, E.S.; Linetsky, V.Ya. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 21p. Order Number DE90607095. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Based on the infinite-dimensional algebra $hsc^{\infty}(4)$ constructed by us, the cubic interaction in the conformal theory of higher-spin fields in four-dimensional space-time is obtained. The theory contains an infinite number of fields of all integer spins $s \geq 2$ and extends the conformal gravity. (author). 23 refs.

4040 (IC–89/179) **Pair production in an electric field in a time-dependent gauge.** Barut, A.O.; Duru, I.H. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 12p. Order Number DE90607096. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A new nonperturbative method of calculation of the pair production in a constant electric field is presented in which the propagator is evaluated entirely by path-integration in a time-dependent potential. This gauge and the path integration correctly define all the normalizations. As a by-product we get also the Unruh formula since the constant electric field provides an accelerated frame. (author). 11 refs.

4041 (IC–89/258) **Geometry and quantization of topological gauge theories.** Birmingham, D.; Blau, M.; Thompson, G. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 39p. (PAR-LPTHE–89/26). Order Number DE90607097. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A general method for constructing interesting topological gauge theories in arbitrary dimensions is presented. The basic framework upon which these models are built is given by the geometrical data of the 'universal bundle with connection' of Atiyah and Singer. The models considered include theories which represent the moduli spaces of flat connections and solutions to the Yang-Mills equations. The former theories correspond to supersymmetric versions of the recently introduced BF systems. In all cases we show explicitly that the quantization can be carried out through the construction of an off-shell nilpotent BRST operator, thus guaranteeing the metric independence of these models. (author). 30 refs.

4042 (INFN-LNF–89/042(PT)) **Structure functions and initial-final state interference in QED.** Greco, M. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1989. 6p. Order Number DE90607098. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Interference effects from initial and final state radiation are explicity introduced within the formalism of structure functions in QED. The analytical results agree with those previously obtained in the approach of coherent states. The method is also suitable for Monte Carlo applications.

4043 (INS–750) **Extended local gauge invariance and the BRS symmetry in stochastic quantization of gauge fields.** Nakazawa, Naohito. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. May 1989. 28p. Order Number DE90719558. Available from NTIS (US Sales Only), PC A03/MF A01.

We investigate the BRS invariance of the first-class constrained systems in the context of the stochastic quantization. For the first-class constrained systems, we construct the nilpotent BRS transformation and the BRS invariant stochastic effective action based on the D+1 dimensional field theoretical formulation of stochastic quantization. By eliminating the multiplier field of the gauge fixing condition and an auxiliary field, it is shown that there exists a truncated BRS transformation which satisfies the nilpotency condition. The truncated BRS invariant stochastic action is also derived. As the examples of the general formulation, we investigate the BRS invariant structure in the massless and massive Yang-Mills fields in stochastic quantization. (author).

4044 (LA-UR–89-3537) **Physics with ultra-low energy antiprotons.** Holtkamp, D.B.; Holzscheiter, M.H.; Hughes, R.J. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-890872–2: Workshop on physics at Fermilab in the 1990's, Breckenridge, CO (USA), 15-24 Aug 1989). Order Number DE90002397. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The experimental observation that all forms of matter experience the same gravitational acceleration is embodied in the weak equivalence principle of gravitational physics. However no experiment has tested this principle for particles of antimatter such as the antiproton or the antihydrogen atom. Clearly the question of whether antimatter is in compliance with weak equivalence is a fundamental experimental issue, which can best be addressed at an ultra-low energy antiproton facility. This paper addresses the issue. 20 refs.

4045 (RAL–89-048) **Half-string oscillator approach to string field theory.** Bordes, J.; Chan Hongmo; Nellen, L.; Tsou Sheungtsun. Rutherford Appleton Lab., Chilton (UK). May 1989. 28p. Order Number DE90607100. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We give an operator formulation of the string field theory proposed by E. Witten using half-string oscillator modes. This formalism, identifying the physical string states as infinite matrices, is developed in such a way that interactions at the level of vertices can be calculated in terms of products and traces of these matrices without relying on ill-defined manipulations of functional integrals. (author).

4046 (RAL–89-052) **Towards a 'pointless' generalisation of Yang-Mills theory.** Chan Hongmo; Tsou Sheungtsun. Rutherford Appleton Lab., Chilton (UK). May 1989. 24p. Order Number DE90607101. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We examine some generalisations in physical concepts of gauge theories, leading towards a scenario corresponding to non-commutative geometry, where the concept of locality loses its usual meaning of being associated with points on a base manifold and becomes intertwined with the concept of internal symmetry, suggesting thereby a gauge theory of extended objects. Examples are given where such generalised gauge structures can be realised, in particular that of string theory. (author).

4047 **Low $_{mo}$perpendicular properties of the pomeron: Theoretical implications in QCD.** . White, A.R. (High Energy Physics Div., Argonne National Lab., Argonne, IL (US)). pp. 657 of Physics simulations at high energy. Barger, V. Gottschalk, T. Halzen, F. World Scientific Pub. Co., Teaneck, NJ (1987).

Experimentally established properties of the Pomeron which cannot be explained within perturbative QCD are reviewed and their theoretical significance elaborated on. The derivation from QCD of a semi-perturbative Pomeron, which has such properties, is described in terms of infra-red divergences of reggeon diagrams and in terms of an infinite momentum winding number condensate due to instanton interactions. The analogy with the known solution of the Schwinger model is emphasized. Asymptotic freedom saturation is needed to justify this picture of the Pomeron and this is satisfied at collider energies if electroweak symmetry breaking is due to color sextet quarks.

4048 **Thirring model on a Riemann surface.** Freedman, D.Z. (Department of Mathematics and Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (US)); Pilch, K. *Annals of Physics (New York) (USA),* 192(2): 331-351 (Jun 1989).

An earlier study of the Thirring model partition function is extended to incorporate twisted boundary conditions on the homology cycles of a genus *g* Riemann surface without boundaries. Two bosonized path integral representations of the Thirring partition function are studied and shown to be equivalent and to reproduce the fermi version including details of spin structures. For manifolds with boundaries, the example of the cylinder shows that the bosonized represenations are equivalent but associated with different de Rham cohomologies. © 1989 Academic Press, Inc.

4049 **String sources in 2+1-dimensional gravity.** Deser, S. (Physics Department, Brandeis University, Waltham, Massachusetts 02254 (US)); Jackiw, R. *Annals of Physics (New York) (USA),* 192(2): 352-367 (Jun 1989).

We exhibit the space-times generated by 1-dimensional open and closed distributions of energy and tension in (2+1)-dimensional gravity. The global structures of these geometries, which are locally flat outside the sources, are described. For tensionless strings, the solutions are just (continuous) superpositions of corresponding particle geometries. However, the conditions for the existence of static strings with tension are quite stringent: not only are closed strings required to have "maximal" mass, but they are in fact equivalent to the ostensibly open ones. © 1989 Academic Press, Inc.

4050 **The spectrum of topological quantum field theories on N-manifolds.** Brooks, R. (Stanford Linear Accelerator Center, CA (USA)). *Nuclear Physics [Section] B (Netherlands),* 325(2): 481-500 (16 Oct 1989). DOE Contract AC03-76SF00515.

The topological particle is first quantized and its spectrum is found to be given by the de Rham cohomology ring of the target manifold. Morse theoretic arguments are used to show how this topological spectrum depends on the gauge fixing. A supermanifold formalism is introduced which leads to the generalized Donaldson invariants. It is found that the topological symmetry cannot be spontaneously or dynamically broken by conventional methods. (orig.).

4051 **Variational calculations in gauge theories.** Kerman, A.K. (Center for Theoretical Physics, Laboratory for Nuclear Science, and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (US)); Vautherin, D. *Annals of Physics (New York) (USA),* 192(2): 408-420 (Jun 1989).

We investigate the possibility of using Gaussian trial wave functionals to describe some of the physics in gauge theories. We derive the variational equations and discuss their properties. In the case of

the vacuum state we consider a special Gaussian *ansatz* whose expectation value corresponds to a constant magnetic field and whose kernel is the second variation of the classical energy around this configuration. We discuss the divergences occurring in the quadratic and quartic terms and the conjecture that they can be absorbed by a renormalization of the coupling constant. This aspect will be examined in a future publication. © 1989 Academic Press, Inc.

4052 **Scattering amplitudes in hot gauge theories.** Pisarski, R.D. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510 (US)). *Physical Review Letters (USA),* 63(11): 1129-1132 (11 Sep 1989).

A consistent method for the perturbative calculation of scattering amplitudes in hot gauge theories is developed. It involves the resummation of a subset of thermal fluctuations, termed hard thermal loops, into effective propagators and vertices. The damping rate of a heavy fermion is computed as an example.

4053 **Neutron electric dipole moment in lattice QCD.** Aoki, S. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973 (US)); Gocksch, A. *Physical Review Letters (USA),* 63(11): 1125-1128 (11 Sep 1989). DOE Contract AC02-76CH00016.

We present an exploratory computation of the electric dipole moment of the neutron induced by a *CP*-violating θ term in the QCD Lagrangian in the framework of quenched lattice QCD. We find $d_N \approx -4\times10^{-14}\theta e$ cm.

4054 **Two-point correlation function of cosmic-string loops.** Bennett, D.P. (Department of Physics and Department of Astrophysics, Princeton University, Princeton, New Jersey 08540 (US)); Bouchet, F.R. *Physical Review Letters (USA),* 63(13): 1334-1337 (25 Sep 1989).

We study the two-point correlations of cosmic-string loops with numerical simulations of the evolution of a cosmic-string network in an expanding universe. We find that the initial positions of loops that are chopped off the network have a correlation function that is quite similar to the highest estimates of the Abell-cluster correlation function, but these correlations are rapidly washed out by the motion of the loops. The implications for the cosmic-string galaxy-formation scenario are briefly discussed.

4055 **Global gauge anomalies for theories with the Green-Schwarz local-anomaly-cancellation mechanism.** Tosa, Y. (Department of Physics, University of Colorado, Campus Box 390, Boulder, Colorado 80309 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(6): 1934-1937 (15 Sep 1989).

We show that theories with the Green-Schwarz mechanism of canceling local anomalies in even dimensions have the possibility of the worst type of global Yang-Mills chiral anomalies given by the homotopy group of the Yang-Mills gauge group. The examples are given for SU(3) gauge theories in six dimensions $[\Pi_6(SU(3))=Z_{31}]$ whose global anomalies are of types $\mathbf{Z}_1$, $\mathbf{Z}_2$, $\mathbf{Z}_3$, and $\mathbf{Z}_6$.

4056 **Momentum-space representation in curved space.** Carreau, M. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(6): 1956-1963 (15 Sep 1989).

A non-Hermitian momentum-space representation of functions of a manifold (curved space) isomorphic to R^n is constructed out of pure plane waves. We prove the covariance of the coordinate- and momentum-space representations. We give the momentum-space representation of the trace of operators. In interacting field theory this representation enables us to calculate the part of the effective action that encodes local properties of a general curved space. Thus the trace anomaly and the beta function can be evaluated. An explicit calculation is displayed at one loop for a scalar field coupled to gravity. In flat space the formalism applies to Cartesian and curvilinear coordinates. Application to the study of the stability of the vacuum of a field theory in curved space is possible.

4057 **Zamolodchikov's *c*-theorem reexamined.** Boyanovsky, D. (Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, Pennsylvania 15260 (US)); Holman, R. *Physical Review [Section] D: Particles and Fields (USA),* 40(6): 1964-1968 (15 Sep 1989).

We present an alternative proof of Zamolodchikov's *c*-theorem using finite-size field-theory methods. We find that although the existence of a *c* function which decreases along renormalization-group flows and coincides with the conformal anomaly at the fixed points is independent of the renormalization scheme, the relationship between the *c* function and the beta function is scheme dependent. We discuss some of the consequences of our proof.

4058 **Block-conjugate-gradient method.** McCarthy, J.F. (Department of Physics, Indiana University, Bloomington, Indiana 47405 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(6): 2149-2152 (15 Sep 1989).

It is shown that by using the block-conjugate-gradient method several, say *s*, columns of the inverse Kogut-Susskind fermion matrix can be found simultaneously, in less time than it would take to run the standard conjugate-gradient algorithm *s* times. The method improves in efficiency relative to the standard conjugate-gradient algorithm as the fermion mass is decreased and as the value of the coupling is pushed to its limit before the finite-size effects become important. Thus it is potentially useful for measuring propagators in large lattice-gauge-theory calculations of the particle spectrum.

4059 **Using the hadronic multiplicity to distinguish real *W*'s from QCD jet backgrounds.** Gunion, J.F. (Department of Physics, University of California at Davis, Davis, California 95616 (US)); Kane, G.L.; Sadrozinski, H.F.; Seiden, A.; Weinstein, A.J. *Physical Review [Section] D: Particles and Fields (USA),* 40(7): 2223-2230 (1 Oct 1989).

In order to study *WW* scattering or the decay of a heavy standard-model Higgs boson in the TeV region, it is necessary to use the channel $W(\rightarrow l\nu)+W(\rightarrow$jets). However, techniques are required for suppressing the severe background from mixed electroweak-QCD production of $W+$jets. We demonstrate that the charged multiplicity of the events can provide an extremely useful tool for distinguishing a jet system originating via real *W* decay from a jet system produced by the mixed electroweak-QCD processes. Analogous techniques will be useful for any process involving Ws$\rightarrow$jets, whenever the *W* decaying to jets has $p_t \gg m_W$ and the primary background produces jets predominantly in a color-nonsinglet state; however the precise procedure must be optimized separately for each such process.

4060 **Four-flavor QCD with intermediate- and light-mass quarks.** Gottlieb, S. (Department of Physics, Indiana University, Bloomington, Indiana 47405 (US)); Liu, W.; Renken, R.L.; Sugar, R.L.; Toussaint, D. *Physical Review [Section] D: Particles and Fields (USA),* 40(7): 2389-2409 (1 Oct 1989).

We present extended simulations of high-temperature QCD for four flavors of staggered fermions with intermediate masses. We find no evidence for a first-order transition with a quark mass of 0.2 with four time slices. Thus, our results support the picture of separated transitions for the pure gauge theory ($m_q \rightarrow \infty$) and QCD with light quarks.

4061 **Electroweak interactions with gauged baryon and lepton numbers.** Rajpoot, S. (Department of Physics, University of California, Riverside, California 92521 (US)). *Physical Review [Section] D: Particles and Fields (USA),* 40(7): 2421-2424 (1 Oct 1989).

The possibility that gauge symmetries associated with baryon and lepton numbers are spontaneously broken symmetries of nature is entertained. In this endeavor, the gauge group of electroweak interactions is $SU(2)\times U(1)^3$. Consistent with neutral-current phenomenology, the spectrum of massive neutral gauge bosons consist of the Z^0 of the standard electroweak model and two additional neutral bosons with mass lower bounds of 120 and 210 GeV which makes these particles prospective candidates for production in the energy regimes of the CERN LEP, Fermilab Tevatron, and the Superconducting Super Collider.

65 PHYSICS II

6510 Nuclear Physics

Refer also to citation(s) 3946, 4127, 4193

4062 (BARC–1464) **Progress report on nuclear data activities in India for the period from July 1987 to December 1988.** Anand, R.P. Bhabha Atomic Research Centre, Bombay (India). 1989. 65p. Order Number DE90607770. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The present progress report on nuclear data activities in India is the sixth in the current new series of progress reports, the first of which was brought out in the year 1981. This report covers the work carried on during the period from July 1987 to December 1988. It contains brief description of various activities such as measurements, evaluations, compilations and processing of nuclear data and other related works being carried out in India. Most of the write-ups in this report describe the work in progress and these are not to be regarded as publications or quoted without permission from the authors. (author).

4063 (CENBG–89-04) **Search for characteristic times governing the emission of two particles from an excited nucleus.** Quebert, J.; Lautridou, P.; Lebrun, C.; Guilbault, F.; Goujdami, D.; Durand, D.; Ardouin, D.; Peghaire, A.; Saint-Laurent, F. Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires. 1989. 15p. (CONF-8901120–: 27. international winter meeting on nuclear physics, Bormio (Italy), 23-27 Jan 1989). Order Number DE90721241. Available from NTIS (US Sales Only), PC A03/MF A01.

The first instants of the evolution of highly excited systems, formed after the collision of two heavy nuclei, are studied. Questions about the average lifetime of the states involved in the excitation of the source, whether the particles emission is sequential and whether particle bursts can be due to possible system compression, are raised. Experimental results, performed at Ganil with two multidetectors of CsI scintillators, are discussed. Data concerning partial display of the six measured correlation functions, two coincidence plots at 57 degrees and a relative angle of 5 degrees for p-p and α - α, a view of the d-d correlation functions versus the average scattering angle and the correlation function values, considered as the projection of a two - dimensional plot. on the Q axis, is given.

4064 (DOE/ER/40405–T2) **Nuclear structure studies at intermediate energies: Interim progress report, 1988–89: September 1988–August 1989.** Hintz, N.M.; Gassaly, M.; Sethi, A.; Franey, M.A.; Mack, A.M.; Mihailidis, D. Minnesota Univ., Minneapolis, MN (USA). Dept. of Physics and Astronomy. Sep 1989. 148p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40405. Order Number DE90002875. Available from NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: inelastic scattering of 650 MeV protons from ^{194,196}Pt; search for recoil free Δ-production in the (p,^{3}He) reaction at 650 MeV; search for low lying magnetic states in ^{48}Ti; E451 inelastic proton cross sections-low spin states in ^{28}Si; E601, collective form factor analysis of ^{208}Pb(π,π') at T_π = 180 MeV; E855, collective form factor analysis of ^{206,207,208}Pb(p,p') at T_p = 650 MeV; proton-nucleus scattering and swelling of nucleons in nuclei; strength of tensor force in medium and mixing of high spin stretched states; Fermilab E581, Coulomb-nuclear polarimeter; Fermilab E704, p + p and $\bar{p}$ + p spin parameters; and density dependent interaction applied to low multipole (p,p') and (p,n) transitions in light nuclei.

4065 (INIS-mf–12013) **Max-Planck-Institute for Nuclear Physics. Annual report 1987.** Klapdor, H.V. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). Abt. fuer Kernphysik); Jessberger, E.K. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). Abt. fuer Kosmophysik) (eds.). Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. 202p. (In German). Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

This annual report contains short communications and extended abstracts about the work performed at the named institute together with a list of publications and talks. The work concerns technical developments on accelerators and ion sources, developments of detectors and experimental setups, electronics, data processing, target developments, giant resonances, nuclear spectroscopy, nuclear reaction mechanisms, atomic physics, medium- and high-energy physics, statistical models of nuclei and nuclear reactions, nuclear reactions at high energies, many-particle theory, quantum chromodynamics, meteorites, comets, interstellar dust, planetary atmospheres, cosmic radiation, molecular collisions in the earth atmosphere, nuclear geology and geochemistry, as well as archaeology. See hints under the relevant topics. (HSI).

4066 (LBL–27833) **Search for the quark-gluon plasma (1989): The NA35 experiment at the CERN SPS.** Pugh, H.G. NA 35 Collaboration. Lawrence Berkeley Lab., CA (USA). Sep 1989. 37p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8908173–2: 6. Nordic meeting on nuclear physics, Kopervik (Norway), 10-15 Aug 1989). Order Number DE90002070. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Results from the NA35 experiment at the CERN SPS are described in the context of possible formation and identification of a quark-gluon plasma (QGP). Evidence is presented that the initial energy density and temperature are sufficient for the QGP to be produced, and that hydrodynamic flow occurs in the expansion stage. Evidence for an unexpectedly large pion source size and for enhanced strangeness production is presented, and discussed in terms of QGP formation. Plans for experiments in 1990–91 with an expanded set up are presented, and prospects for a program with Pb beams at the SPS are discussed. 39 refs., 12 figs.

4067 (LBL–27885) **Testing string dynamics in lepton nucleus reactions.** Gyulassy, M.; Pluemer, M. Lawrence Berkeley Lab., CA (USA). Oct 1989. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8908148–2: International workshop on relativistic aspects of nuclear physics, Rio de Janeiro (Brazil), 28-31 Aug 1989). Order Number DE90003127. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The sensitivity of nuclear attenuation of 10-100 GeV lepton nucleus (ℓA) reactions to space-time aspects of hadronization is investigated within the context of the Lund string model. We consider two mechanisms for attenuation in a nucleus: final state cascading and string flip excitations. Implications for the evolution of the energy density in nuclear collisions are discussed. 16 refs., 10 figs.

4068 (PCCF-T–88-18) **Study of the energetic proton production in relativistic heavy ions Ne + nuclei collisions, using Diogene detector. Hadronic matter temperature.** Rahmani, A. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. Dec 1988. 165p. (In French). Order Number DE90721243. Available from NTIS (US Sales Only), PC A08/MF A01.

The study of the proton's production differential cross sections, in the collision of relativistic heavy ions, allows to obtain the nuclear-matter temperature and gives information about the nucleons large burst pulses in the nucleus. The chosen thermodynamic model is a generalized approach of the R. Hagedorn model, applied to heavy ions collisions: the nuclear matter is divided in volume elements δV assumed to be in thermal and chemical equilibrium and emitting particles and fragments isotropically, inside their own system. The applied nuclear-matter velocity distribution depended only on the impact parameter and on the relationship between the chemical potential and the temperature. The predictions of this thermodynamic model were compared to the Saturne experimental results, using Diogene detector. The obtained temperature values are similar to those given by D. Hahn and H. Stoker. The proton production cross sections were measured for backward emitting angles. A relationship between the cross sections and the burst pulse distribution in the nuclei was settled.

4069 (RCNP-P–102) **Workshop for cascade project, physics using large acceptance spectrograph and its technical considerations.** Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Mar 1989. 140p. (In Japanese). (CONF-8807195–: Workshop for cascade project, Ibaraki (Japan), 13 Jul 1988). Order Number DE90719707. Available from NTIS (US Sales Only), PC A07/MF A01.

The Workshop for Cascade, subtitled 'Physics Using Large Acceptance Spectrograph and Its Technical Considerations', was held on July 13, 1988 by the Nuclear Physics Research Center, Osaka University. The present proceedings carry a total of 18 reports, which are entitled 'RCNP Large Acceptance Spectrograph (plan)',

'Correlation Experiments with a System Consisting of a Small Number of Nucleons', 'Measurement of (d,d) and (d,^{2}He) Reactions with Large Solid Angle Spectrograph', 'The (p,2p) and (p,pn) Reactions', 'Correlation Experiments with Large Acceptance Spectrograph', 'Efforts at Determination of Various Correlations in Alpha Particles', 'Two-Nucleon Correlation in Nucleus', 'A Study on Particle Migration Reaction with Broad-Band Spectrograph', 'Measurement of Response in Highly Excited State during Nucleon Migration Reaction', 'A Study on Δ-Excitation within Nucleus', 'A Few Problems Related with Response in Highly Excited State', 'Spin-Isospin Modes in Continuum', '(p,π) and (p,xπ) Reactions', 'Formation of π^- in (p,2p) Reaction', 'Formation of π-Mesonic Atom with Consistent Momentum', 'Measurement of Excitation Functions by Means of 'Inconsistent' Dispersion in Magnetic Spectrograph', 'Deeply Bound π^- States by 'π^- Transfer' (n,p) Reactions', and 'On High Resolution (n,p) Facilities'. (N.K.).

6511 Experimental Techniques

Refer also to citation(s) 3070

4070 (BNL–42814) **Neutron-antineutron oscillations in nuclei.** Dover, C.B.; Gal, A.; Richard, J.M. Brookhaven National Lab., Upton, NY (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8903138–1: ILL workshop on fundamental physics with slow neutrons, Grenoble (France), 8-11 Mar 1989). Order Number DE90003254. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We briefly review the state of the art for extracting the period of neutron-antineutron oscillations from the lifetime of nuclei. The most recent data on nuclear stability provide a limit of 10^8 s for the oscillation period. 13 refs.

6512 Nuclear Properties and Reactions, A=1-5, Experimental

Refer also to citation(s) 4080

4071 (CENBG–88-25) **Experimental and theoretical study of two center electron emission in 25-MeV/u Mo^{40+} + He collisions.** Stolterfoht, N.; Schneider, D.; Tanis, J.; Altevogt, H.; Scheurer, J.N.; Andriamonje, S.; Bertault, D.; Chemin, J.F.; Fainstein, P.D. Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires. 1988. 4p. (CONF-880955–: International conference on the physics of multiply charged ions and international workshop on E.C.R. ion sources, Grenoble (France), 12-16 Sep 1988). Order Number DE90721240. Available from NTIS (US Sales Only), PC A02/MF A01.

The importance of two-center electron emission, for ions with energies in the GeV range, is shown. The experiments were carried out at the LISE beam line of the GANIL cyclotron, using the electron spectroscopy apparatus from the HMI (Berlin). The ratio of cross sections for electron production by 25 MeV/u Mo^{40+} and H^+ impact (for 20 and 150 degrees observation angles) are given. The increase of the two-center effect with the increasing electron energy is observed.

4072 (INIS-mf–12013, pp. 55-56) **^{4}He(e,e'c) coincidence experiments for investigation of charge symmetry in ^{4}He.** Khan, S. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Kihm, T.; Knoepfle, K.T.; Schulz, H.J.; Spahn, M.; Friedrich, J.; Voegler, N.; Schmitt, C.; Walther, V.H. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

^{4}He(e,e'c) coincidence electron scattering allows us to study simultaneously the p and n decays from the giant dipole resonance region in ^{4}He by detecting besides the protons in particular the ^{3}H and ^{3}He recoil nuclei in the same detector system. The data analysis aims at a precise determination of the ratio $R=\sigma[^4He(e,e',p)]/\sigma[^4He(e,e',n)]$ in the energy interval $22<E_x<35$ MeV. This ratio is of strong interest since it is supposedly around $E_x=25$ MeV close to 2 indicating thus a severe charge symmetry breaking in ^{4}He. (orig.).

4073 (LA-UR–89-3535) **Interpretation of recent LAMPF results on D T MU formation.** Leon, M. Los Alamos National Lab., NM (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8909262–1: Muon catalyzed fusion meeting, Oxford (UK), 10-13 Sep 1989). Order Number DE90002398. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the results from muon-catalyzed fusion experiments at lampf. Cycling rates were measured and compared to calculated results. 8 refs., 5 figs. (LSP)

4074 (RCNP-P–105, pp. 33-35) **Measurement of the analyzing power of p(n,γ)d reaction.** Suda, T. (Tohoku Univ., Sendai (Japan). Coll. of General Education); Maeda, K.; Takahisa, K.; Sakai, H.; Matsuoka, N.; Yosoi, M.; Tamura, K.; Okamura, H. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Jul 1989. In *Proceedings of the workshop on neutron scattering and neutron reactions.* Order Number DE90705941. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. NEUTRON REACTIONS/capture; NEUTRON REACTIONS/polarization-asymmetry ratio; CAPTURE; POLARIZED BEAMS; HYDROGEN 1 TARGET; GAMMA RADIATION; DEUTERIUM; MEV RANGE 10-100

6513 Nuclear Properties and Reactions, A=6-19, Experimental

Refer also to citation(s) 3956, 4427

4075 (INIS-mf–12013, pp. 57-58) **The interference term between nuclear charge and nuclear current matrix elements of the E1 giant resonance in ^{12}C and ^{58}Ni.** Khan, S. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Kihm, T.; Knoepfle, K.T.; Schulz, H.J.; Spahn, M.; Emrich, H.J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Via the (e,e'p) reaction the longitudinal-transverse interference term of the nuclear-response function has been measured in the giant dipole region of ^{12}C and ^{58}Ni by exploiting its explicit $\cos\phi_p$ dependence; ϕ_p is the azimuthal emission angle of the proton with respect to the axis of momentum transfer. (orig.).

4076 (INIS-mf–12013, pp. 68) **Time of flight measurements at the pulsed proton beam.** Khan, S. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Kihm, T.; Knoepfle, K.T.; Schulz, H.J.; Seeger, M.; Spahn, M.; Steyaert, J.J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The claim for a tachyon signal produced by bombarding ^{12}C by 12 MeV protons could not be confirmed. (orig.).

4077 (INIS-mf–12013, pp. 92-93) **Effect of vacuum polarization on the sub-Coulomb ^{12}C-^{12}C scattering.** Baur, G. (Kernforschungsanlage Juelich GmbH (Germany, F.R.). Inst. fuer Kernphysik); Boeglin, W.; Egelhof, P.; Henneck, R.; Klein, A.; Muehry, H.; Plattner, G.R.; Sick, I.; Trautmann, D.; Vetterli, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

In order to investigate the effect of vacuum polarization on the Coulomb interaction between hadrons, the differential cross section for elastic ^{12}C-^{12}C-scattering at $E_{lab}=4$ MeV was measured at angles near 45^0 with high precision. Special care was taken for various sources of systematic errors. The data are compared with theoretical calculations taking into account the contribution due to the Uehling potential. The contribution of various other effects such as relativistic effects, nuclear interaction, nuclear polarizability and electronic screening are discussed. The result provides a QED-test on the 9% level, the accuracy of the screening correction being the limiting factor for accuracy. (orig.).

4078 (INIS-mf-12013, pp. 93) **Thick-target ^{21}Ne yield of the reaction ^{18}O(α,n)^{21}Ne in the range 4.0-8.8 MeV.** Huenemohr, H. (Max-Planck-Institut fuer Chemie (Otto-Hahn-Institut), Mainz (Germany, F.R.)); Begemann, F.; Habs, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The thick-target ^{21}Ne yield of the ^{18}O(α,n)^{21}Ne reaction has been measured with $^{18}O_2$ filled gas targets for α-particle energies between 4.0 and 8.8 MeV. The amounts of ^{21}Ne and ^{4}He have been determined by isotope dilution with a noble gas mass spectrometer. (orig.).

4079 (LA-11685-T) **Cross sections and analyzing powers of ^{15}N(p,n)^{15}O at 200 MeV and 494 MeV.** Ciskowski, D.E. Los Alamos National Lab., NM (USA). Nov 1989. 163p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE90002909. Available from NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

Differential cross sections and analyzing powers have been measured for the ^{15}N(p,n)^{15} O(g.s.) reaction at bombarding energies of 200 MeV and 494 MeV. The 494 MeV data were obtained at the LAMPF Neutron Time-Of-Flight Facility on an 82 m flight path with a resolution of about 2.7 MeV. The 200 MeV data were obtained at IUCF on a 76m flight path with a resolution of about 1.1 MeV. At both energies, the measured analyzing power is small, the magnitude is less than .2 for momentum transfers of less than 1 fm^{-1}. In contrast, both Relativistic and standard DWIA calculations predict a maximum of A=-.7 near q=0.7 fm^{-1}. 53 refs., 44 figs.

4080 (RCNP-P-105, pp. 1-7) **Scatterings and reactions by means of polarized neutron beam.** Koori, N. (Kyushu Univ., Fukuoka (Japan). Faculty of Engineering). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Jul 1989. (In Japanese). In *Proceedings of the workshop on neutron scattering and neutron reactions.* Order Number DE90705941. Available from NTIS (US Sales Only), PC A06/MF A01.

A high resolution polarized neutron beam should be prepared for nuclear physics, which will be planned with the new ring cyclotron at RCNP. Studies on scatterings and reactions by means of polarized neutron beams are reviewed briefly. Beam lines for polarized neutrons are summarized. An example of high resolution measurements of neutron induced reactions is described. (author).

6514 Nuclear Properties and Reactions, A=20-38, Experimental

Refer also to citation(s) 4085

4081 (ANL/PPRNT-89-196) **Fragmentation of high-spin particle-hole states in ^{26}Mg.** Segel, R.E.; Amusa, A.; Geesaman, D.F.; Lawson, R.D.; Zeidman, B.; Olmer, C.; Bacher, A.D.; Emery, G.T.; Glover, C.W.; Nann, H. Argonne National Lab., IL (USA). 1989. 35p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. Order Number DE90003013. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The inelastic scattering of 134 MeV protons to seven 6$^-$ states in ^{26}Mg has been studied. By combining the results with those of a companion electron scattering study, and utilizing DWIA calculations, it has been possible to extract isoscalar and isovector excitation amplitudes. Shell model calculations using $(1d_{5/2})^{10-n-p}(2s_{1/2})^{n}(1f_{7/2})^{p}$, with p = 0 and 1, model spaces can reproduce the general features of the fragmentation, but not the structure of the yrast 6$^-$ state. 28 refs., 10 figs., 2 tabs.

4082 **Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures.** Wang, T.F. (Yale Univ., New Haven, CT (USA). Wright Nuclear Structure Lab.); Champagne, A.E.; Hadden, J.D.; Magnus, P.V.; Smith, M.S.; Howard, A.J.; Parker, P.D. *Nuclear Physics [Section] A (Netherlands),* 499(3): 546-564 (31 Jul 1989). DOE Contract AC02-76ER03074.

Using the ^{27}Al(^{3}He,t)^{27}Si reaction, we have located and measured accurate excitation energies for seven states in ^{27}Si between the ^{26}Al+p threshold and the lowest observed ^{26}Al(p,γ)^{27}Si resonance. By examining the mirror states in ^{27}Al via the ^{26}Mg(^{3}He, d)^{27}Al and ^{26}Mg(α,t)^{27}Al reactions, we find that in the ^{26}Al+p channel there can be at most only one s-wave resonance that lies below the lowest directly observed resonance; this possible l=0 resonance most probably corresponds to either the 7589, 7557 or 7533 keV state in ^{27}Si. The remaining six states are most probably formed via l$\geq$2 proton capture. Upper limits for the reduced proton widths of these states have been used to estimate an upper limit for the ^{26}Al(p,γ)^{27}Si thermonuclear reaction rate. (orig.).

6515 Nuclear Properties and Reactions, A=39-58, Experimental

Refer also to citation(s) 4075, 4096, 4112

4083 (DOE/ER/40389-56) **Muon capture at large y-energetic nucleon emission.** Martoff, C.J. Temple Univ., Philadelphia, PA (USA). Dept. of Physics. [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40389. (CONF-8906160-7: Yamada conference on nuclear weak processes and nuclear structure, Osaka (Japan), 12-15 Jun 1989). Order Number DE90002568. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Capture of a negative muon by a nucleus leads in some fraction of cases to emission of a nucleon carrying a substantial fraction of the entire available energy $Q = \Delta m + m_\mu - B_\mu$. Here Δm is the difference of initial and final (excited) nuclear masses, m_μ is the muon mass, and B_μ is the atomic binding energy of the muon before capture. This corresponds to emission of nucleons with 350-420 MeV/c of momentum, while the momentum transfer at the leptonic vertex is small and generally timelike ($| Q^2 |<100$MeV/c). Such high momentum emitted particles have very poor wave function overlap with bound nucleons in conventional nuclear models, making the observed rates much too large to account for in such models. In this report I will examine energetic nucleon data from muon capture in ^{40}Ca, to see how this reaction can be understood. I will show that in addition to the usual IA mechanism, the data requires an additional capture interaction between the muon and a pair of nucleons. The resulting nucleon and neutrino energy/momentum distribution in the rest system of the (pair + muon) is essentially given by phase space. The strength of the pair capture relative to the IA is several per cent. 21 refs., 3 figs.

4084 (INIS-BR-1764) **Decay of ^{57}Ni.** Santos Scardino, A.M. dos. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. 1987. 120p. (In Portuguese). Order Number DE90607783. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The decay of ^{57}Ni to ^{57}Co was studied by gamma ray spectroscopy using both singles and coincidence spectra. The sources were obtained with the ^{58}Ni (Y,n) ^{57}Ni reaction. Natural metallic nickel was irradiated in the bremsstrahluhng beam of the linear accelerator of the Instituto de Fisica da Universidade de Sao Paulo with 30 MeV electrons. The singles espectra were taken with 104 cc HPGe detector and the coincidences espectra with 27 and 53cc Ge(Li) and 104 cc. HPGe detectors. The energies of transitions that follow the ^{57}Ni decay were measured using ^{56}Co as standard (which was obtained by (Y,np) reaction in ^{58}Ni) and taking into account the cascade cross-over relations. (author).

4085 (INIS-mf-12013, pp. 59-60) **Emission of fast protons in (e,e'p) coincidence experiments.** Reiner, K. (Tuebingen Univ. (Germany, F.R.). Physikalisches Inst.); Grabmayr, P.; Mauser, G.; Mertens, G.; Wagner, G.J.; Friedrich, J.; Voegler, N.; Pugatch, V. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The inelastic response of ^{58}Ni to 183 MeV electrons from MAMI A at Mainz has been investigated up to excitation energies of 41 MeV for four momentum transfers between 0.4 and 0.8 fm^{-1}, and of ^{28}Si for two momentum transfers up to E_x=39 MeV. We have detected fast protons with energies up to 33 MeV using plastic scintillator telescopes. The angular correlations for the prominent kinematical bands show strong forward-backward asymmetry with

shapes typical of the populated state in the residual nucleus. A comparison to RPA calculations is in progress. (orig.).

4086 (INIS-mf–12013, pp. 83-84) **Preequilibrium emission of neutrons in central heavy-ion collisions at 15-20 MeV/A bombarding energy.** Belim, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Gentner, R.; Keller, K.; Lassen, L.; Luecking, W.; Schreck, R.; Seibert, U.; Cassing, W.; Gemmeke, H.; Neumann-Cosel, P. von. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Preequilibrium neutron emission was investigated in centrl collisions of the mass symmetric system 15, 20 MeV/A $^{40}Ar+^{40}Ca$ and the asymmetric system 14.6 MeV/A $^{16}O+^{64}Ni$. For $^{40}Ar+^{40}Ca$ at 20 MeV/A bombarding energy, the preequilibrium component was properly determined from neutron energy spectra and angular distributions. The experimental data agree very well with predictions from a quantal phase-space model which takes into account mean-field dynamics as well as successive two-body collisions. From this comparison it follows that nuclear relaxation times are rather short in finite fermion systems at intermediate energies. The results stress the importance of nucleon-nucleon collisions in the dynamics of light particle emission during the early stages of the reaction already at these energies. (orig.).

4087 (RCNP-P–105, pp. 27-32) **(n,p) reactions and the nuclear structures.** Yabe, Masayuki (Shinshu Univ., Matsumoto, Nagano (Japan)). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Jul 1989. In *Proceedings of the workshop on neutron scattering and neutron reactions.* Order Number DE90705941. Available from NTIS (US Sales Only), PC A06/MF A01.

The possibilities of (n,p) reactions are reported in relation to the investigation of nuclear structures. (n,p) charge-exchange reactions at intermediate incident energies are suitable tools to study the spin-isospin properties (β^+-excitation modes) of nuclei. Two examples of these possibilities are shown. One is available to the investigation of the Ikeda sum rule for Gamow-Teller (GT) transitions. We show that the sum rule can be tested by subtracting zero degree (n,p)-from (p,n)-spectra. Microscopic analyses of the (n,p) and (p,n) reactions on ^{48}Ca are presented for intermediate energy. Another possibility is related to the double-beta decay. For its precise analysis reliable matrix elements of β^+-transitions from the final state of the double-beta decay are required, which are available from the investigation of the (n,p) reaction on the same state. (author).

6516 Nuclear Properties and Reactions, A=59-89, Experimental

Refer also to citation(s) 3956, 4086

4088 (CRN-PN–85-31) **Study of the structure of the transition nuclei ^{152}Dy, ^{154}Dy and ^{156}Er at high angular momentum.** Azgui, F. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). 1985. 154p. (In French). Order Number DE90721092. Available from NTIS (US Sales Only), PC A08/MF A01.

Measurements of feeding times of high spin yrast states in ^{152}Dy, ^{154}Dy and ^{156}Er were utilized to obtain information about possible spin dependent shape changes. Feeding times as well as lifetimes were determined with the recoil distance technique. In ^{152}Dy only long feeding times (> 10 ps) could be identified, indicating that the aligned-particle yrast states are fed through configuration of similar character, with little direct population from collective cascade in the continuum region. In ^{154}Dy discrete states with $I \leq 30$ have lifetimes which are characteristically collective, whereas the preyrast cascade exhibit both fast (< 1 ps) and long (> 10 ps) feeding components. The latter imply a change with increasing spin from collective to aligned-particle character, signalling a prolate to oblate shape transition. In ^{156}Er the yrast states up to spin 20 Planck constant were found to be collective. These levels are fed, however, from long-lived high spin states, causing time delay up to ~ 100 ps, the existence of which is interpreted as a signature for an oblate shape at high spin.

4089 (INIS-mf–12013, pp. 60-62) **Direct decay of giant resonances in medium-heavy nuclei.** Khan, S. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Kihm, T.; Knoepfle, K.T.; Schulz, H.J.; Spahn, M.; Friedrich, J.; Voegler, N.; Dolbilkin, B.; Kondratiev, R.; Lisin, V. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

A model independent multipole analysis of $^{64}Zn(e,e'c)$ coincidence data yields E1 and E2 (E0) form factors and the respective strength distributions for all charged decay channels and the indirectly accessible neutron channel. The angular correlation analysis of the α_0-channel yields a relative E1-E2 phase of $\simeq 90^0$. Sum rule arguments and decay properties indicate the presence of isovector giant E2(E0) strength. Strong direct decay contributions are found in the proton channels, where decay from E1 populates hole states clearly different from those populated from E2(E0) excitations, revealing their different 1p-1h-structure. (orig.).

4090 (INIS-mf–12013, pp. 65-66) **Results of the α-scattering on the even, stable Ge isotopes.** Gyufko, R.; Kruechten, B. v.; Madadakis, E.; Rech, M.; Rychel, D.; Schuermann, B.; Speer, J.; Wiedner, C.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The systematic high resolution studies of the (α, α') experiments on $^{70,72,74,76}Ge$ have been completed. For $E(\alpha)$=31.5 MeV and a Q3D-spectrograph resolution of 12-25 keV about 50 excited levels have been identified for each isotope up to an excitation energy of about 5 MeV. The data were compared to DWBA-calculations assuming collective form factors. Within the framework of the implicit folding model isoscalar transition strengths have been extracted. Their fragmentation with increasing neutron number has been determined for different multipolarities. (orig.).

4091 **Shapes of ^{59}Cu nuclei at moderate excitation energies and spin.** Viesti, G. (Istituto Nazionale di Fisica Nucleare and Dipartimento di Fisica dell'Universita di Bari, Bari (Italy)); Anghinolfi, M.; Corvisiero, P.; Djilavian, L.; Taiuti, M.; Bortignon, P.F.; Gramegna, F.; Prete, G.; Natowitz, J.B.; Nebbia, G.; Zucchiatti *Physical Review [Section] C: Nuclear Physics (USA),* 40(4): 1570-1573 (Oct 1989).

Continuum γ-ray spectra from the decay of ^{59}Cu formed at excitation energies of 54 and 74 MeV and angular momenta up to 40ħ have been measured and analyzed. The parameters of the giant dipole resonance have been extracted using the statistical model. The giant dipole resonance parameters for the lower excitation energy agree well with published data for spherical ^{63}Cu nuclei. At the higher excitation, the giant dipole resonance strength distribution is not described by a single Lorentzian fit in disagreement with the findings for ^{63}Cu at the same excitation energy. This seems to be correlated with the onset of spin driven deformations as recently evidenced from the shapes of evaporative particle spectra.

6517 Nuclear Properties and Reactions, A=90-149, Experimental

Refer also to citation(s) 3956, 4103

4092 (INIS-mf–12013, pp. 66) **α-scattering on ^{100}Mo.** Gyufko, R.; Kruechten, B. v.; Madadakis, E.; Rech, M.; Rychel, D.; Schuermann, B.; Speer, J.; Wiedner, C.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Scattering of 32.2 MeV α particles from ^{100}Mo has been studied with an energy resolution of 20 keV. Angular distributions were measured from 10 to 40 degrees for an E(x) range up to 3.7 MeV. Several new spin assignments have been made by comparison of the angular distributions to collective model DWBA calculations. An implicit folding procedure was used to derive isoscalar transition rates. (orig.).

4093 (INIS-mf–12013, pp. 66-67) **Systematics of the (^{18}O,^{20}Ne) reaction and the determination of the mass excess of ^{122}Cd.** Gyufko, R.; Kruechten, B. v.; Madadakis, E.; Rech, M.; Rychel, D.; Schuermann, B.; Speer, J.; Wiedner, C.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

While the first results of the (^{18}O,^{20}Ne) reaction have been described qualitatively in the last annual report, the investigations of the reaction mechanism of this two proton stripping reaction leading to the ground state have been concluded with a semiclassical description. Based on Coulomb trajectories a parametrisation in terms of incident energy, reaction Q-value, target mass and charge describe the angular distributions quite satisfactorily. In particular the angle for maximum cross section can be predicted to within 3 degrees. Based on this the ^{124}Sn(^{18}O,^{20}Ne)^{122}Cd reaction has been performed to establish the mass excess of ^{122}Cd. (orig.).

4094 (INIS-mf–12013, pp. 80-81) **Search for 2-γ decay of the first excited 0$^+$ state in ^{98}Mo.** Engelke, V. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Gerl, J.; Schirmer, J.; Schwalm, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

In an attempt to measure the 2-γ decay of the first excited 0_2^+ state in ^{98}Mo an upper limit of $W_{\gamma\gamma}/W_{tot} \leq 1.4 \times 10^{-5} (1\sigma)$ was obtained. (orig.).

4095 (INIS-mf–12013, pp. 84-85) **γ-multiplicity distributions for fusion reactions at and below the barrier.** Hennrich, H.J. (Giessen Univ. (Germany, F.R.). 2. Physikalisches Inst.); Breitbach, G.; Kuehn, W.; Metag, V.; Novotny, R.; Schwalm, D.; Habs, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Investigations of angular momentum distributions in sub-barrier heavy ion fusion reaction have been continued. The systems ^{32}S+^{100}Mo and ^{36}S+^{96}Mo, both leading to the same compound nucleus ^{132}Ce, have been studied, using the Darmstadt-Heidelberg crystal ball. Evaporation residues of the S+Mo reaction have been identified by time-of-flight using a parallel plate counter positioned under forward angles. γ-multiplicity distributions for both systems are compared. With decreasing bombarding energy the fusion cross section and the average γ-multiplicity decrease more rapidly in the ^{36}S+^{96}Mo system compared to the ^{32}S+^{100}Mo system. (orig.).

4096 (INIS-mf–12013, pp. 89-90) **Study of multi-fragmentation in collisions of heavy ions.** Gnirs, M.; Pelte, D.; Trazska, M.; Winkler, U. Heidelberg-GSI-Giessen-Florence-GANIL Collaboration. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The multi-fragmentation of the heavy ion system Ar+Ar, Mo+Mo and Sn+Sn is studied at bombarding energies 15 MeV$<$E/A$<$25 MeV. Fragment multiplicities up to m_F=6 are measured; the fragment momenta are used to determine the fragmentation dynamics. It is concluded that the major part of the observed fragments comes from a fast break-up process. (orig.).

4097 (INIS-mf–12013, pp. 93-95) **Quasielastic scattering of polarized ^{23}Na.** Becker, K. (Marburg Univ. (Germany, F.R.). Fachbereich 13 - Physik); Blatt, K.; Fick, D.; Korsch, W.; Leucker, H.; Luck, W.; Reich, H.; Moroz, Z.; Butsch, R.; Jansch, H. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The (quasi-) elastic scattering of polarized ^{23}Na from ^{90}Zr and ^{206}Pb was measured. The (besides the 3rd ranks) complete set of analysing powers of the elastic and quasielastic scattering from ^{90}Zr was analysed within the framework of coupled-channel calculations and the recently developed concept of 'tidal-symmetry'. The measurements with ^{206}Pb were done to investigate the energy dependence of the optical potential and to study the influence of this energy dependence on the fusion cross section and analysing power T_{20} at energies around the barrier. (orig.).

4098 (INIS-SU–119/A, pp. 370) **Neutron cross sections of tin and cadmium isotopes in the range of 0.5-2.0 MeV.** Musaelyan, R.M. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij); Ovdienko, V.D.; Sklyar, N.T.; Skorkin, V.M.; Smetanin, G.A.; Surkova, I.V.; Fedorov, M.B.; Yakovenko, T.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev (USSR), 14-18 Sep 1987). In *Neutron physics. V. 3.* Order Number DE90705913. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

T-12589.

Short note. CADMIUM ISOTOPES/neutron reactions; TIN ISOTOPES/neutron reactions; DIFFERENTIAL CROSS SECTIONS; ELASTIC SCATTERING; INELASTIC SCATTERING; KEV RANGE 100-1000; MEV RANGE 01-10; TOTAL CROSS SECTIONS

4099 (LBL–27894) **Binary complex fragment emission and multifragmentation from very hot nuclei.** Moretto, L.G.; Wozniak, G.J. Lawrence Berkeley Lab., CA (USA). Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8910237–4: International school seminar on heavy ion physics, Dubna (USSR), 3-12 Oct 1989). Order Number DE90003082. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Complex fragments at low and intermediate energies originate mostly from the binary decay of a compound nucleus formed in either complete or incomplete fusion. With increasing bombarding energy incomplete fusion should terminate. Evidence of this occurrence is given. As the excitation energy increases, multifragment decay becomes prevalent. The sources of ternary and quaternary events, characterized in terms of their velocity and total charge, do not seem to differ from that of binary events. 9 refs., 13 figs.

4100 **Excitation energy equilibration in damped ^{139}La+^{40}Ar collisions at 15 MeV per nucleon.** Wile, J.L. (Departments of Chemistry and Physics and Nuclear Structure Research Laboratory, University of Rochester, Rochester, New York 14627 (US)); Datta, S.S.; Schroder, W.U.; Huizenga, J.R.; de Souza, R.T.; Pade, D. *Physical Review [Section] C: Nuclear Physics (USA),* 40(4): 1700-1710 (Oct 1989).

Energy and angular distributions of neutrons emitted in coincidence with projectile-like fragments from the damped reaction ^{139}La+^{40}Ar at a bombarding energy of 600 MeV have been measured. Components corresponding to sequential emission from two fully accelerated reaction fragments as well as preequilibrium neutron emission have been separated as a function of energy loss and fragment atomic number. The deduced division of total excitation energy between the reaction partners is very well described by the one-body nucleon-exchange model for all energy losses. The data provide no evidence for correlations between the excitation energy division and the measured projectile-like fragment atomic number.

6518 Nuclear Properties and Reactions, A=150-189, Experimental

Refer also to citation(s) 4168, 4429

4101 (CONF-890902–20) **The study of exotic N $\simeq$ 82 nuclei using the Daresbury recoil mass separator.** McNeill, J.H.; Chishti, A.A.; Gelletly, W.; Hotchkis, M.A.C.; Varley, B.J.; Blomqvist, J.; Daly, P.J.; Piiparinen, M.; Woods, P.J. Oak Ridge National Lab., TN (USA). [1989]. 34p. Sponsored by Academy of Finland; U.S. DOE Energy Research; U.K. Science and Engineering Research Council. DOE Contract AC05-84OR21400. From 198. American Chemical Society national meeting; Miami, FL (USA); 10-15 Sep

1989. Order Number DE90001079. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Experiments using the Daresbury Recoil Mass Separator have identified microsecond isomers in the exotic N = 82, 83 nuclei ^{153}Yb, ^{153}Lu, ^{154}Hf, and have established their decay schemes. The results for ^{153}Lu and ^{154}Hf, together with those for lighter N = 82 isotones, provide an outstanding illustration of the dependence of E2 transition rates between J^n states on the subshell occupation, and demonstrate that half-filling of the $\pi h_{11/2}$ subshell in the N = 82 series occurs just below Z = 71 ^{153}Lu. The result of the isomer in the even-odd N = 83 nucleus ^{153}Yb shows that the isomerism is due to a low-energy E2 transition rather than an E3 transition as in lighter N = 83 even-odd isotones, which is another consequence of the $\pi h_{11/2}$ subshell being about half-filled. Furthermore, the long-lived isomer observed in the odd-odd N = 83 nucleus ^{154}Lu also reflects that the $\pi h_{11/2}$ subshell is close to being half-filled. 23 refs., 12 figs., 4 tabs.

4102 (INIS-mf–12013, pp. 62-65) **Angular momentum dependence of the dipole giant resonance in hot nuclei.** Thirolf, P. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Schwalm, D.; Fischer, R.D.; Metag, V. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The analysis of high energy γ-rays from the decay of the electric giant dipole resonance (GDR) in the reaction ^{130}Te(^{34}S,xn) $^{164-xn}$Er at E_{lab}=156 MeV, measured as a function of the γ-ray multiplicity using the Darmstadt-Heidelberg crystal ball, was continued. New methods were employed to combine the information contained in the γ-ray angular distributions and the energy spectra in a consistent way. Exploiting the multiplicity information of the crystal ball, a model independent decomposition of the γ-ray energy spectra into the angular momentum components with ΔI=0 and ΔI=+-1 could be achieved as a function of the spin of the evaporation residues. A consistent description of both the angular distributions and energy spectra can only be obtained (i) by assuming the nuclei in the spin- and excitation energy region studied ($I \geq 30$ Planck constant, $E^* \simeq$ 50 MeV) to have an oblate nuclear deformation with the spin axis pointing in the direction of the symmetry axis (γ=-60^0) and (ii) by allowing the centroid energy E_R to decrease with increasing spin. (orig.).

4103 (INIS-mf–12013, pp. 70-71) **Measurement of g-factors in Yb isotopes.** Lubkiewicz, E. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Kulessa, R.; Habs, D.; Emling, H.; Grein, H.; Simon, R.S.; Wollersheim, H.J.; Ender, C.; Gerl, J.; Schwalm, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. YTTERBIUM ISOTOPES/ gyromagnetic ratio; NICKEL 64 TARGET/molybdenum 100 reactions; MOLYBDENUM 100 REACTIONS/heavy ion fusion reactions; YTTERBIUM 159; YTTERBIUM 160; YTTERBIUM 161; ROTATIONAL STATES; HIGH SPIN STATES; YRAST STATES; DE-EXCITATION; ENERGY SPECTRA; GAMMA SPECTRA; MEV RANGE 100-1000; EXPERIMENTAL DATA; NEUTRONS; PHOTONS; GAMMA CASCADES; MAGNETIC DIPOLE MOMENTS; NUCLEAR MAGNETIC MOMENTS; ANGULAR CORRELATION

4104 (INIS-mf–12013, pp. 71) **Measurement of γ angular distributions in ^{152}Dy and ^{152,153}Ho.** Piepke, A.; Sanchez, H.; Mansour, N.; Klapdor, H.V. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

γ angular distributions of the nuclei ^{152}Dy and ^{152,153}Ho were measured by the reaction ^{122}Sn(^{35}Cl,xn) at E_{Lab}=167 MeV. (orig.).

4105 (INIS-mf–12013, pp. 90-91) **High energetic photons from heavy ion collisions.** Breitbach, G. (Giessen Univ. (Germany, F.R.). 2. Physikalisches Inst.); Koch, G.; Kuehn, W.; Metag, V.; Novotny, R.; Ruckelshausen, A.; Tschesche, S.; Grosse, E.; Stroeher, H.; Schwalm, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The production of energetic photons in the reaction ^{16}O(15 MeV/u) on ^{nat}W has been measured with the Darmstadt-Heidelberg crystal ball. The photon spectra below 10 MeV and above 25 MeV show exponential shapes with slope parameters of 1.2 MeV and 4.7 MeV, respectively. For the giant dipole resonance region we find an experimental cross section, which is 1.2 mb above the sum of the 2 exponential fits. The angular distribution for photon energies above 25 MeV is forward peaked, and in relatively good agreement with isotropic emission from the nucleon-nucleon center of mass system. (orig.).

4106 (JYFL-RR–3/1988) **Transfer reactions with very heavy ions. Quarterly report 3. quarter 1987.** Juutinen, Sakari. Jyvaeskylae Univ. (Finland). Dept. of Physics. Mar 1988. 96p. Order Number DE90607797. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

This thesis deals with the reaction mechanism of the few-nucleon transfer reactions between the ^{58}Ni projectiles and the Dy targets. A series of transfer experiments utilizing the particle-γ coincidence technique was performed. Particle detection was used to give the scattering angles of two reaction products and the reaction channel was selected by the discrete γ-rays in the Ge detectors. Total γ-ray energy and multiplicity distributions were measured by the Spin Spectrometer. Total γ-ray energy and multiplicity distributions, γ-ray spectra obtained by the Ge and NaI detectors and angular distributions of the projectile-like ions are discussed. For one- and two-neutron transfer the experimental results provide direct evidence of a cold mechanism populating high-spin states near the yrast line. A schematic model for the transfer mechanism is proposed. This model accounts for the prominent features of one- and two-neutron pickup.

6519 Nuclear Properties and Reactions, A=190-219, Experimental

Refer also to citation(s) 4097, 4120

4107 (CONF-890686–3) **Observation of superdeformation in ^{191}Hg.** Moore, E.F.; Janssens, R.V.F.; Chasman, R.R.; Ahmad, I.; Khoo, T.L.; Wolfs, F.L.H.; Ye, D.; Beard, K.B.; Benet, Ph.; Grabowski, Z.W.; Cizewski, J.A.; Drigert, M.W. Argonne National Lab., IL (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38;AC07-76ID01570;FG02-87ER40346. From International conference on new aspects of nuclear spectroscopy; Crete (Greece); 26-30 Jun 1989. Order Number DE90002208. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The first observation of superdeformation in the A $\simeq$ 190 mass region is reported. A rotational band of 12 transitions with an average energy spacing of 37 keV, an average moment of inertia of 110 $\hbar^2$ MeV^{-1}, and an average quadrupole moment of 18 $\pm$ 3 eb has been observed in ^{191}Hg. These results are in excellent agreement with a calculation that predicts an ellipsoidal axis ratio of 1.65:1 for the superdeformed shape in this nucleus. Evidence for another discrete superdeformed band and superdeformed structures in the quasi-continuum was also found in the data. 19 refs., 6 figs.

4108 (DOE/ER/40281–4) **Relativistic heavy ion research: Progress report, November 15, 1988–November 14, 1989.** Columbia Univ., New York, NY (USA). [1989]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER40281. Order Number DE90002115. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Participation in the E802 Experiment, which is the first major heavy-ion experiment at the BNL-AGS, is the main focus of this paper. The emphasis of the E802 experiment are on accurate particle identification and measurements of spectra over a wide kinematical domain ($5° < \theta < 55°$, $p < 20$ GeV/c) and measurements of small-angle two-particle correlations, with event characterization tools:

multiplicity array, forward and large-angle calorimeters. Data taking with the present device is almost completed and is expected to be finished in the fall of 1989.

4109 (INIS-mf–12013, pp. 99-101) **Coulomb breakup of ^{7}Li.** Brucker, A. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Trauth, M.G.; Wurm, J.P.; Lindl, B.; Muffler, R. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Resonant and direct breakup of ^{7}Li was investigated in the reaction 70 MeV ^{7}Li+^{208}Pb with regards to the influence of the Coulomb field of the target on the relative energy distribution of α and t, measured in coincidence in wide geometry. The differences between relative energy spectra measured in-plane and out-of-plane suggest a reduction of the lifetime of the 4.633 MeV resonance and large effects on the trajectories after direct breakup due to the close proximity of Pb. (orig.).

4110 (RCNP-P–105, pp. 110-116) **Studies of deeply bound π^- states by (n,p) and (d,^{2}He) pion transfer reactions.** Yamazaki, Toshimitsu (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Jul 1989. In *Proceedings of the workshop on neutron scattering and neutron reactions.* Order Number DE90705941. Available from NTIS (US Sales Only), PC A06/MF A01.

We propose to search for deeply bound π^- states in heavy nuclei by high resolution spectroscopy using (n,p) and (d,^{2}He) reactions on heavy targets. Recent calculation by Toki and Yamazaki shows that even in ^{208}Pb the deeply bound pionic states (1s, 2p, etc.) are expected to have narrow widths due to the repulsive nature of the pion-nucleus interaction. To populate those hitherto unknown deeply bound states they proposed to use 'pion transfer' reactions such as (n,pπ^-), etc. We describe the structure of deeply bound pionic atoms and the formation of those states. (author).

6520 Nuclear Properties and Reactions, A=220 and Above, Experimental

Refer also to citation(s) 3105, 4134

4111 (CONF-890982–5) **Intercomparison of U-238 deposits employed for neutron fluence determination in neutron activation cross section measurements.** Meadows, J.W.; Smith, D.L.; Winkler, G.; Vonach, H.; Wagner, M. Argonne National Lab., IL (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International meeting on neutron activation cross sections for fission and fusion energy applications; Argonne, IL (USA); 11-15 Sep 1989. Order Number DE90001919. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An intercomparison is made between a collection of five uranium deposits used for neutron fluence determination in neutron activation experiments at Argonne National Laboratory (ANL), Illinois, USA, and a single corresponding deposit from the Institut fuer Radiumforschung und Kernphysik (IRK), Vienna, Austria. The predominant uranium isotope in each of these deposits is U-238. Two methods were used in the study: low-solid-angle alpha counting and the measurement of fast-neutron fission yield ratios. This investigation produced the following calibration values for the IRK deposit: (160.6 $\pm$ 1.7) micrograms from alpha counting and (163.3 $\pm$ 2.0) micrograms from fission ratio measurements. The latter value is a weighted average of twenty-four separate measurements. 13 refs., 2 figs., 4 tabs.

4112 (INDC(CCP)–302/L) **Translation of selected papers published in Nuclear Constants 4, 1986.** International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. 83p. Order Number DE90607803. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-268/G.

The document includes the English translation of 7 papers published in the Russian journal Nuclear Constants 4, 1986 and dealing with neutron data evaluations for actinide nuclei and iron. Refs, figs and tab.

4113 (INIS-mf–12013, pp. 58-59) **(e,e'f) coincidence experiments for fission decay of giant resonances in ^{235,238}U.** Weber, T. (Giessen Univ. (Germany, F.R.). Inst. fuer Kernphysik); Heil, R.D.; Kneissl, U.; Pecho, W.; Wilke, W.; Emrich, H.J.; Kihm, T.; Knoepfle, K.T. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Extending previous work on ^{238}U, ^{235}U(e,e'f) coincidence data were taken at 4 momentum transfers yielding both E1, E2/E0 and E3 form factors and the respective multipole strength distributions in the giant resonance region of ^{238}U ($4<E_x<22$ MeV). From the analysis of time-of-flight difference spectra, the fission widths ratio Γ_x/Γ_a is obtained as a function of excitation energy for separated multipoles. The giant E2 resonance exhibits an increased symmetric fission contribution compared to E1 and E3 resonances. (orig.).

4114 (INIS-mf–12013, pp. 76-79) **Investigation of many-phonon excitations in ^{232}Th.** Korten, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Heyng, H.W.; Gerl, J.; Ender, C.; Helmolt, U. v.; Schwalm, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

A Coulomb excitation experiment was performed on ^{232}Th with 396 MeV ^{90}Zr-projectiles to investigate the structure of side bands in ^{232}Th. Thereby a new band with a bandhead at 1414 keV was discovered. The branching ratios and particle-γ angular correlations indicate a spin of $I^{\pi}=4^+$ and K=4 for this state. Since this band decays exclusively into the γ-band - no evidence for a direct decay to the ground state band was found - and due to the collectivity of these transitions we propose this band to be the two phonon $\gamma\gamma$-band. (orig.).

4115 (INIS-mf–12013, pp. 74-76) **Heavy ion induced transfer reactions with ^{232}Th by the Crystal Ball.** Gerl, J. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Ender, C.; Helmolt, U. v.; Schwalm, D.; Wollersheim, H.J.; Korten, W.; Habs, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Transfer reaction around the Coulomb barrier were studied in the system ^{90}Zr->^{232}Th. The analysis of γ-ray intensities revealed impact parameter dependent form factors for the 1n, 2n and 4n pick-up channel. The rather flat form factor slopes can be explained by reduced effective neutron binding energies. In case of ^{231}Th this reduction is reflected by the measured γ-sum energy, whereas in ^{230}Th and ^{228}Th sequential n-transfer via highly excited intermediate states must be assumed to explain the data. The system ^{18}O->^{232}Th was used to identify yrast levels of ^{234}Th populated in the 2n stripping reaction up to the 12^+ state. (orig.).

4116 (INIS-mf–12013, pp. 72-74) **Spectroscopic investigations of the neutron-deficient nuclei ^{220}Th and ^{222}Th.** Schwartz, B. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Schwalm, D.; Dahlinger, M.; Kankeleit, E.; Simon, R.S.; Habs, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

High spin states in ^{220}Th and ^{222}Th were populated in the reactions ^{208}Pb(^{16}O,4n) ^{220}Th and ^{208}Pb(^{18}O,4n)^{222}Th at 93 MeV and 94 MeV, respectively. In ^{222}Th the ground state band could be followed up to the 26^+ state showing a sequence of states of alternating parity connected by strong E1- and crossover E2-transitions up to the highest spins. Such a sequence is expected in the case of octupole deformed nuclei. In ^{220}Th, which shows a similar alternating parity structure as ^{222}Th, we observe a backbend at a rotational frequency of ω=0.22 MeV/Planck constant in agreement with theoretical predictions. (orig.).

4117 (INIS-mf–12013, pp. 85-89) **Search for a fission fragment anisotropy signal after optical spin exchange pumping on**

^{242m}Am. Achenbach, W. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Habs, D.; Ames, F.; Backe, H.; Lauth, W.; Scherrer, A.; Toelg, S.; Rimke, H.; Wilhelmy, J.B. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

With an improved experimental set-up we searched again for an anisotropy signal in the fission fragment angular distribution of the 14 ms ^{242m}Am fission isomer. The ^{242m}Am isomers were implanted in an optical cell filled with 25 mbar N_2 buffer gas and rubidium vapour with a density of about $4x10^{13}/cm^3$. The rubidium atoms were polarized by pumping the D_1-transition with circular-polarized light of a pulsed copper vapour dye laser combination. In this manner the fission isomers can be polarized by spin exchange collisions. Evidence for a small fission fragment anisotropy will be reported. (orig.).

4118 (INIS-mf–12013, pp. 95-98) **Detection of the γ branch for the shape isomer in ^{236}U.** Schirmer, J. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Gerl, J.; Schwalm, D.; Habs, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Using the Heidelberg-Darmstadt Crystal Ball (CB) spectrometer and the ^{235}U(d, p) reaction at 11 MeV, first results on the γ-decay of the ^{236}U shape isomer have been obtained. The isomer could be identified by requiring that the prompt and delayed γ-sum-energy add up to the excitation energy measured in the (d, p) reaction with a surface barrier ring counter. Two dominant γ-cascades depopulating the shape isomer via two known 1^- levels (688 keV, 967 keV) have been observed, leading to an excitation energy of $E(O_{II}^+)$=2.77+-0.04 MeV. A preliminary branching ratio of the γ decay via two γ-rays to the delayed fission amounts to $\Gamma_{\gamma\gamma}/\Gamma_{fis}$=7+-4. γ-transitions preceding the decay of the shape isomer have been measured and are tentatively interpreted as deexcitation of collective states in the second minimum. (orig.).

4119 (JAERI-M–89-143) **Measurements of prompt fission neutron spectra and double-differential neutron inelastic-scattering cross sections for ^{238}U and ^{232}Th.** Baba, Mamoru; Wakabayashi, Hidetaka; Itoh, Nobuo; Maeda, Kazuto; Hirakawa, Naohiro. Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment; Tohoku Univ., Sendai (Japan). c 13 Sep 1989. 63p. (In Japanese). Sponsored by Japan Atomic Energy Research Institute. (NEANDC(J)–142/U;INDC(JPN)–129/L). Available from Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, 319-11, Japan.

This report presents the summary of experimental studies of prompt fission neutron spectra and double-differential neutron inelastic-scattering cross sections of ^{238}U and ^{232}Th. The experiments were performed at Tohoku University Fast neutron Laboratory employing a time-of-flight technique and Dynamitron accelerator as the pulsed neutron generator. From the experiments, we obtained the following data for both nuclei; prompt fission neutron spectrum for 2 MeV neutrons, double-differential neutron inelastic-scattering cross sections for 1.2, 2.0, 4.2, 6.1 and 14.1 MeV incident neutrons. Both in experiments and data processing, cares were taken to obtain reliable data by avoiding systematic uncertainty. The experimental data were compared with those by other experiments, evaluations and model calculations. Through the data comparison, some fundamental problems were found in the experiments by previous authors and the evaluations. The present data will provide useful data base for refinement of the evaluated data and theoretical models. 29 refs., 32 figs., 4 tabs.

4120 (LBL–27878) **Delayed-fission properties of neutron-deficient americium nuclei.** Hall, H.L. Lawrence Berkeley Lab., CA (USA). 23 Oct 1989. 125p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC03-76SF00098. Order Number DE90003274. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Characteristics of the delayed-fission decay mode in light americium nuclei have been investigated. Measurements on the unknown isotopes ^{230}Am and ^{236}Am were attempted, and upper limits on the delayed-fission branches of these nuclei were determined. Evidence of the existence of ^{236}Am was observed in radiochemical separations. Total kinetic energy and mass-yield distributions of the electron-capture delayed-fission mode were measured for ^{232}Am ($t_{1/2}$ = 1.31 $\pm$ 0.04 min) and for ^{234}Am ($t_{1/2}$ = 2.32 $\pm$ 0.08 min), and delayed-fission probabilities of 6.9×10^{-4} and 6.6×10^{-5}, respectively, were determined. The total kinetic energy and the asymmetric mass-yield distributions are typical of fission of mid-range actinides. No discernible influence of the anomalous triple-peaked mass division characteristic of the thorium-radium region was detected. Measurements of the time correlation between the electron-capture x-rays and the subsequent fission conform that the observed fissions arise from the electron-capture delayed-fission mechanism. Delayed fission has provided a unique opportunity to extend the range of low-energy fission studies to previously inaccessible regions. 71 refs., 44 figs., 13 tabs.

4121 (NEACRP–302-L(Rev.)) **Data for decay Heat Predictions Proceedings of a specialists' meeting.** Nuclear Energy Agency, 75 - Paris (France). 1987. 386p. (CONF-8709122–: Specialists' meeting on data for decay heat predictions, Studsvik (Sweden), 7-10 Sep 1987; NEANDC–245-U). Order Number DE90721127. Available from NTIS (US Sales Only), PC A17/MF A01.

These proceedings of a specialists' meeting on data for decay heat predictions are based on fission products yields, on delayed neutrons and on comparative evaluations on evaluated and experimental data for thermal and fast fission. Fourteen conferences were analysed.

4122 (UCRL–100763) **Results from heavy-ion bombardments of ^{254}Es.** Hulet, E.K. Lawrence Livermore National Lab., CA (USA). 26 Sep 1989. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910237–3: International school seminar on heavy ion physics, Dubna (USSR), 3-12 Oct 1989). Order Number DE90002810. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We report our experimental work and offer our most recent data on the decay properties for five new isotopes of Md, No, Lr, and for ^{258m}Md. In addition to these successful experiments, we have also conducted searches for ^{263}[105], ^{264}[105], ^{272}[109], and superheavy elements. Finally, we summarize our conclusions based on what we have learned so far and what we believe are the most critical directions that should now be taken. 19 refs., 15 figs.

6530 Nuclear Theory

Refer also to citation(s) 4004, 4066, 4097, 4099

4123 (BNL–43385) **Deformed proximity potential for heavy ion reactions.** Baltz, A.J. Brookhaven National Lab., Upton, NY (USA). Sep 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8908173–1: 6. Nordic meeting on nuclear physics, Kopervik (Norway), 10-15 Aug 1989). Order Number DE90002295. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The proximity potential is discussed for the inelastic scattering of a spherical nucleus on a deformed nucleus or the mutual interaction of two deformed nuclei. It is shown that the proximity potential is, in general, geometrically more correct than the usual centerline prescription used in inelastic scattering analyses. For the cases where the proximity potential is inadequate a folding model approach is advocated. Techniques to facilitate the coupled channels analysis are presented. 11 refs., 6 figs.

4124 (CONF-8905143–19) **Variational theory of nuclear and neutron matter.** Pandharipande, V.R.; Wiringa, R.B. Argonne National Lab., IL (USA). Jun 1989. 20p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. From NATO advanced study institute international advanced course on the nuclear equation of state; Peniscola (Spain); 12 May - 3 jun 1989. Order Number DE90002202. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In these lectures we will discuss attempts to solve the A = 3 to ∞ nuclear many-body problems with the variational method. We

choose the form of a variational wave function $X_\nu(1, 2 \cdots A)$ to describe the ground state. The X_ν and the ground-state energy E_ν are obtained by minimizing $E_\nu = \langle X_\nu|H|X_\nu\rangle/\langle X_\nu|X_\nu\rangle$ with respect to variations in X_ν. If the form of the variational wave function is chosen properly we can expect $X_\nu \approx X_0$ and $E_\nu \approx E_0$ where X_0 and E_0 are the exact ground-state wave function and energy. In general $E_\nu \geq E_0$ in variational calculations. 63 refs., 11 figs.

4125 (DOE/ER/40417–4) **Global trends and structural consequences of the proton-neutron interaction.** Zhang, J.-Y.; Brenner, D.S.; Casten, R.F.; Wesselborg, C.; Warner, D.D. Clark Univ., Worcester, MA (USA). [1989]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40417;AC02-76CH00016. (CONF-8909247–1: ACS symposium on exotic nuclear spectroscopy, Miami Beach, FL (USA), 11-15 Sep 1989; BNL–43376). Order Number DE90002545. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

It has long been recognized that nuclei do not have deformed ground states or exhibit significant collective behavior unless they contain minimum numbers of both protons and neutrons beyond closed shell configurations. In medium mass and heavy nuclei, for example, it has been shown that each valence nucleon must have available 4-10 valence nucleons of the opposite type before deformation sets in. Empirically is is found that experimental observables such as $B(E2:2^+_1 \rightarrow 0^+_1)$ values and $E_4{}^+_1/E_2{}^+_1$ ratios, which are sensitive indicators of the degree of collectivity and deformation, correlate to a remarkable extent with the valence nucleon product, N_pN_n, which can be viewed as a rough first-order approximation to the integrated p-n interaction strength. Thus it has become clear that the p-n interaction among valence nucleons is largely responsible for deformation, configuration mixing and collectivity in nuclear matter. The success of the N_pN_n scheme has refocussed attention on the critical role played by the attractive p-n force in nuclear structure and we shall explore, here, several aspects of the interaction which have been highlighted by recent studies of empirical p-n interaction strengths. 23 refs., 8 figs.

4126 (DOE/ER/40427–09-N9) **The b_1 structure function and nuclear pions.** Miller, G.A. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-8901115–6: Topical conference on electronuclear physics with internal targets, Stanford, CA (USA), 9-12 Jan 1989). Order Number DE90003337. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The b_1 structure function is measurable in deep inelastic scattering from polarized nuclei with unpolarized beams. The contributions of nuclear pions are evaluated and found to be small, about 2%. 8 refs.

4127 (DOE/ER/40427–12-N9) **Space-time symmetries in nuclei.** Henley, E.M. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1989]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-8906160–8: Yamada conference on nuclear weak processes and nuclear structure, Osaka (Japan), 12-15 Jun 1989). Order Number DE90003335. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The theories or models of space-time symmetries are reviewed. The status of these theories and related experiments are assessed. 39 refs., 6 figs., 3 tabs.

4128 (DOE/ER/40427–20-N9) **[Nuclear theory]: Annual progress report.** Washington Univ., Seattle, WA (USA). Inst. for Nuclear Theory. Jun 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. Order Number DE90003348. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report discusses concepts in nuclear theory such as: neutrino nucleosynthesis; double beta decay; neutrino oscillations; chiral symmetry breaking; T invariance; quark propagator; cold fusion; and other related topics. (LSP)

4129 (IC–89/133) **Validity of the adiabatic rotational model in the case of the Hexadecupole operator.** Sharma, S.K.; Raina, P.K. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 14p. Order Number DE90607666. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The validity of the rotational model expressions relating the E4 transition probabilities and the intrinsic hexadecupole moments is examined in the light of the recent data on the inelastic electron-scattering form factors for the $0^+ \rightarrow 4^+$ transitions in some medium-mass nuclei. (author). 14 refs, 2 figs, 2 tabs.

4130 (IC–89/182) **Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions.** Khosla, H.S.; Malik, S.S.; Gupta, R.K. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 16p. Order Number DE90607715. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The structural configurations of the quasi-molecular resonance states, at energies both below and above the Coulomb barrier, are studied within the orbiting cluster model approach. A generalized moment of inertia expression for the two-centre shell model nuclear shape, that applies also to dinuclear configurations, is used. Applications of the method are made to $^{12}C+^{12}C$, $^{16}O+^{12}C$, $^{16}O+^{16}O$, $^{24}Mg+^{24}Mg$ and $^{28}Si+^{28}Si$ systems. Further experimental investigations are needed. (author). 18 refs, 6 figs, 2 tabs.

4131 (IC–89/187) **Two-centre electron scattering phase shifts calculated to higher orders using the generalized JWKB method.** Chandel, S.S.; Gupta, R.K. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 9p. Order Number DE90607716. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The phase shifts with correction to order $(h/2\pi)^4$ for the scattering of high energy electrons from a two-centre Coulomb potential are obtained in the generalized JWKB method. Free particle and central Coulomb radial equations are used as the "model equations". Good convergence is obtained, except for one phase shift with $l = 0$, $m = 0$. (author). 9 refs, 2 tabs.

4132 (IC–89/202) **Positive energy bound states.** Awin, A.M. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 41p. Order Number DE90607667. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Positive energy bound states (PEBS) are introduced through a brief historical background. Few examples, including cases with partial waves higher than the 0^{th} order, are then demonstrated. Related problems, such as the modification of Levinson's theorem, PEBS with perturbations and the interpretation of PEBS have been reviewed. The present status of the subject is then discussed. (author). 21 refs, 11 figs.

4133 (IC–89/209) **Double beta decay matrix elements in the Germanium region.** Sharma, S.K.; Mukherjee, G.; Rath, P.K. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 10p. Order Number DE90607755. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The matrix elements involved in the double beta decay process for the nuclei ^{76}Ge and ^{82}Se are calculated in terms of the variational wavefunctions resulting from realistic effective interactions operating in the unrestricted $(2p_{1/2}, 2p_{3/2}, 1f_{5/2}, 1g_{9/2})^{\pi,\nu}$ configuration space. (author). 10 refs, 2 tabs.

4134 (INDC(NDS)–220) **Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.** Lemmel, H.D. (ed.). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. 339p. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The document contains the proceedings of the IAEA Consultants' Meeting on the Physics of Neutron Emission in Fission, Mito City (Japan), 24-27 May 1988. Included are the conclusions and recommendations reached at the meeting and the papers presented by the meeting participants. These papers cover the following topics: Energy dependence of the number of fission neutrons ν-bar (3 papers), multiplicity distribution of fission neutrons (3 papers), competition between neutron and γ-ray emission (4 papers), the fission neutron yield in resonances (2 papers) and the energy spectrum of fission neutrons in experiment (9 papers), theory (4 papers) and

evaluation (1 paper). A separate abstract was prepared for each of these papers. Refs, figs and tabs.

4135 (INIS-mf–12013, pp. 67-68) **Systematics of neutron single particle energies for 16≤A≤50.** Khan, S.; Kihm, T.; Knoepfle, K.T.; Mairle, G.; Schulz, H.J.; Seeger, M.; Spahn, M.; Wen, S. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Neutron single particle energies were determined from neutron stripping and pickup experiments in the mass region 16≤A≤50. The data show simple relations in regions between nuclei with shell closure, which can be parametrized by linear functions of proton and neutron number of the respective nuclei. (orig.).

4136 (INIS-mf–12013, pp. 68-70) **Single neutron transfer reactions induced by polarized ^{7}Li ions.** Becker, K. (Marburg Univ. (Germany, F.R.). Fachbereich 13 - Physik); Blatt, K.; Chanda, A.; Fick, D.; Grawert, G.; Butsch, R.; Paul, P.; Moroz, Z.; Rusek, K.; Turkiewicz, I. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Cross section and analyzing powers of various rank for the single neutron transfer reactions induced by polarized ^{7}Li ions at energy of 44 MeV on ^{26}Mg and ^{120}Sn targets have been analysed with quantum mechanical and semiclassical models. (orig.).

4137 (INIS-mf–12013, pp. 82-83) **Calculation of 2ν double beta decay of ^{76}Ge, ^{82}Se, ^{128,130}Te.** Muto, K.; Klapdor, H.V. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Half-lives of 2ν $\beta\beta$ decay are calculated for ^{76}Ge, ^{82}Se and ^{128,130}Te in the quasi-particle random-phase-approximation (QRPA) with a realistic nucleon-nucleon interaction. (orig.).

4138 (INIS-mf–12013, pp. 81) **Proton-neutron quasiparticle RPA and charge-changing transitions.** Muto, K.; Bender, E.; Klapdor, H.V. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. BETA DECAY/random phase approximation; PHONONS; PROTON-NEUTRON INTERACTIONS; EVEN-ODD NUCLEI; ODD-EVEN NUCLEI; ODD-ODD NUCLEI; PARTICLE-HOLE MODEL; NUCLEAR STRUCTURE; CORRELATIONS; BOGOLYUBOV TRANSFORMATION; PERTURBATION THEORY

4139 (INIS-mf–12013, pp. 81-82) **Calculation of β^{-}-decay half-lives by the proton-neutron QRPA.** Bender, E.; Muto, K.; Staudt, A.; Klapdor, H.V. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

β^{-}-decay half-lives of neutron-rich nuclei are calculated in the QRPA. The obtained decay rates agree well with the experimental data. For the application of this model to nuclei far from stability, we have examined the dependence of the calculated half-lives on the model parameters. (orig.).

4140 (INIS-mf–12013, pp. 125) **Aspects of chaos in nuclear physics.** Bohigas, O. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Inst. de Physique Nucleaire); Weidenmueller, H.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. NUCLEAR STRUCTURE/stochastic processes; NUCLEAR MATTER

4141 (INIS-mf–12013, pp. 125) **Partial level densities in precompound reactions.** Nishioka, H.; Weidenmueller, H.A.; Yoshida, S. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. PRECOMPOUND-NUCLEUS EMISSION/energy-level density; STATISTICAL MODELS; ERICSON THEORY; QUANTUM MECHANICS; STATISTICAL MECHANICS; EXCITON MODEL; EXCITONS; NUCLEAR STRUCTURE

4142 (INIS-mf–12013, pp. 125) **An approximation for shell-model level densities.** Pluhar, Z.; Weidenmueller, H.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. SHELL MODELS/energy-level density; EIGENFUNCTIONS; ANALYTIC FUNCTIONS; EXPECTATION VALUE; HILBERT SPACE; HAMILTONIANS; NUCLEAR STRUCTURE; ENERGY DEPENDENCE; EIGENVALUES; COMMUTATION RELATIONS; INTEGRALS

4143 (INIS-mf–12013, pp. 125) **Statistical theory of precompound reactions: The multistep direct process.** Nishioka, H.; Weidenmueller, H.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. PRECOMPOUND-NUCLEUS EMISSION/statistical models; NUCLEAR STRUCTURE; DIRECT REACTIONS; EIGENFUNCTIONS; ADIABATIC APPROXIMATION; SUDDEN APPROXIMATION

4144 (INIS-mf–12013, pp. 125) **Sensitivity of the fluctuating cross-section to time-reversal violation.** Davis, E.D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. T INVARIANCE/compound-nucleus reactions; COMPOUND-NUCLEUS REACTIONS/fluctuations; RESONANCE; SYMMETRY BREAKING; DETAILED BALANCE PRINCIPLE; EXCITATION FUNCTIONS; FLUCTUATIONS; SENSITIVITY; ENERGY DEPENDENCE

4145 (INIS-mf–12013, pp. 126) **Variance in the fluctuating cross-section.** Boose, D. (Texas A and M Univ., College Station (USA). Cyclotron Inst.); Davis, E.D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. COMPOUND-NUCLEUS REACTIONS/fluctuations; ENERGY DEPENDENCE; MATRIX ELEMENTS; EXPECTATION VALUE; RANDOMNESS; STATISTICAL MODELS; S MATRIX; EXCITATION FUNCTIONS; FLUCTUATIONS; RESONANCE; THREE-DIMENSIONAL CALCULATIONS; INTEGRALS; NUCLEAR STRUCTURE; LEVEL WIDTHS; COMPOUND NUCLEI; EXCITED STATES; ERICSON THEORY

4146 (INIS-mf–12013, pp. 126) **Compound elastic enhancement.** Mueller, A.; Harney, H.L. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. COMPOUND-NUCLEUS REACTIONS/elastic scattering; EXCITED STATES; RESONANCE; STATISTICAL MODELS; DECAY AMPLITUDES; NUCLEAR STRUCTURE; NUCLEAR DECAY; COMPOUND NUCLEI

4147 (INIS-mf–12013, pp. 126) **On a class of integrals appearing in the theory of statistical nuclear reactions.** Harney, H.L.; Lanza, E.G.; Pereyra, P. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. NUCLEAR REACTIONS/statistical models; MATRICES; INTEGRAL CALCULUS; INTEGRALS; RANDOMNESS; HAUSER-FESHBACH THEORY

4148 (INIS-mf–12013, pp. 126) **The statistical theory of nuclear reactions in the limit of isolated resonances.** Harney, H.L.; Huepper, A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. COMPOUND-NUCLEUS REACTIONS/statistical models; RESONANCE; MATRIX ELEMENTS; ASYMPTOTIC SOLUTIONS; RANDOMNESS; S MATRIX; CORRELATIONS

4149 (INIS-mf–12013, pp. 127) **Microscopic description of heavy ion reactions in the Fermi energy domain.** Bohnet, A.; Aichelin, J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. HEAVY ION REACTIONS/nuclear reaction kinetics; FERMI LEVEL; STATISTICAL MECHANICS; SPALLATION; BREAKUP REACTIONS; NUCLEAR PROPERTIES; NUCLEAR STRUCTURE

4150 (INIS-mf–12013, pp. 128) **Electromagnetic decay of hot rotating nuclei.** Egido, J.L.; Weidenmueller, H.A. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. CRANKING MODEL/e2-transitions; CRANKING MODEL/m1-transitions; NUCLEAR STRUCTURE/e2-transitions; NUCLEAR STRUCTURE/m1-transitions; ROTATIONAL STATES; DE-EXCITATION; TEMPERATURE DEPENDENCE; HARTREE-FOCK-BOGOLYUBOV THEORY; E2-TRANSITIONS; M1-TRANSITIONS; NUCLEAR TEMPERATURE; GAMMA DECAY; RANDOM PHASE APPROXIMATION; STRENGTH FUNCTIONS

4151 (INIS-mf–12013, pp. 131) **Meteorite tracking network.** Kiko, J. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Hauth, G.; Kirsten, T.; Ceplecha, Z. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. GLUON MODEL/drell model; DRELL MODEL/nuclear reactions; NUCLEAR REACTIONS/inclusive interactions; RELATIVISTIC RANGE; MUON PAIRS; PAIR PRODUCTION; STRUCTURE FUNCTIONS; MUONS PLUS; MUONS MINUS; GLUONS; NUCLEAR STRUCTURE; BREMSSTRAHLUNG; TRANSVERSE MOMENTUM

4152 (INS–745) **Breaking of separability condition for dynamical collective subspace. Onset of quantum chaos in large-amplitude collective motion.** Sakata, Fumihiko; Yamamoto, Yoshifumi; Marumori, Toshio; Iida, Shinji; Tsukuma, Hidehiko. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1989. 45p. Order Number DE90719506. Available from NTIS (US Sales Only), PC A03/MF A01.

It is the purpose of the present paper to study 'global structure' of the state-space of an N-body interacting fermion system, which exhibits regular, transient and stochastic phases depending on strength of the interaction. An optimum representation called a dynamical representation plays an essential role in this investigation. The concept of the dynamical representation has been introduced in the quantum theory of dynamical collective subspace in our previous paper, in order to self-consistently determine an optimum collective subspace as well as an optimum collective Hamiltonian. In the theory, furthermore, dynamical conditions called separability and stability conditions have been provided in order to identify the optimum collective subspace as an approximate invariant subspace of the Hamiltonian. Physical meaning of these conditions are classified from a viewpoint to relate breaking of them with bifurcation of the collectivity and an onset of quantum chaos from the regular collective motion, by illustrating the general idea with numerical results obtained for a simple soluble model. It turns out that the onset of the stochastic phase is associated with dissolution of the quantum numbers to specify the collective subspace and this dissolution is induced by the breaking of the separability condition in the dynamical representation. (author).

4153 (INS–748) **Nuclear collective rotation in the SU_3 model, 2. Quantal rotation for a triaxial configuration.** Kinouchi, Shin-ichi; Kishimoto, Teruo; Kammuri, Tetsuo. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. May 1989. 36p. Order Number DE90719508. Available from NTIS (US Sales Only), PC A03/MF A01.

The collective rotation of a nuclear system with the SU_3 Hamiltonian is described by the quantal dynamical nuclear field theory. An angular frequency in the Coriolis interaction of the driving Hamiltonian is replaced by a total angular momentum operator divided by the corresponding moment of inertia. We consider here the low spin states for a triaxial intrinsic configuration. The rotational effect is taken into account by using the effective quadrupole and angular momentum operators, whose expressions are different depending on whether they refer to the laboratory frame or the body-fixed one. Effective forms of the total Hamiltonian and the particle angular momentum are compared with the exact SU_3 energy and the rotor's angular momentum, respectively. In order to dissolve the disagreement for the effective operators, the perturbing interaction should be supplemented by a residual part of the quadrupole-quadrupole interaction, which restores the rotational invariance of the intrinsic Hamiltonian. (author).

4154 (INS–749) **Nuclear collective rotation in the SU_3 model, 3. Quantal rotation for an axially symmetric configuration.** Kinouchi, Shin-ichi; Kishimoto, Teruo; Kammuri, Tetsuo. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. May 1989. 17p. Order Number DE90719509. Available from NTIS (US Sales Only), PC A03/MF A01.

Quantal form of the dynamical nuclear field theory is used for the description of the collective rotation of a nuclear system with the SU_3 Hamiltonian. Low spin states for an axially symmetric configuration with maximum alignment and $K = 0$ are treated. A residual part of the QQ force, which restores the rotational invariance of the intrinsic Hamiltonian, is employed together with the Coriolis coupling. The effective particle angular momentum is equal to that of the rotor up to second order. The effective Hamiltonian coincides with the exact SU_3 energy. The E2-matrix elements within the $K = 0$ band agree with the exact values given by Bohr and Mottelson. (author).

4155 (INS–751) **Dissipation mechanism of the large-amplitude collective motion. Dynamical evolution of a collective bundle of trajectories in the TDHF phase space for a simple soluble model.** Matsuo, Masayuki; Sakata, Fumihiko; Marumori, Toshio. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jun 1989. 43p. Order Number DE90719557. Available from NTIS (US Sales Only), PC A03/MF A01.

A new microscopic origin responsible for the dissipation process of the large-amplitude collective motion is discussed in terms of the dynamics of distribution function in the time-dependent Hartree Fock (TDHF) phase space. With the use of a simple soluble model, the origin is illustrated by numerically solving the master equation in the microscopic theory of nuclear collective dynamics which has been proposed by the present authors aiming at studying the order-to-chaos transitions of the large-amplitude nuclear collective motion. In this framework, collectivity of the system is expressed by a bundle of trajectories in the TDHF phase space and the dissipation process is related to the diffusive property of the bundle of trajectories. It is clarified that the microscopic dynamics responsible for the dissipation process originates from the dynamical fluctuation part of the coupling between the collective (relevant) and intrinsic (irrelevant) degrees of freedom. (author).

4156 (JAERI-M–89-093) **Fracto-fusion. Mechanism of cold fusion.** Takeda, Tatsuoki; Takizuka, Tomonori. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 19p. Order Number DE90719573. Available from NTIS (US Sales Only), PC A03/MF A01.

As a cold fusion mechanism we investigated a fracto-fusion by which reacting particles are accelerated by the electric field generated between the crack surfaces in a crystal and the beam fusion occurs. By assuming the possible magnitude of the potential difference we calculated the fusion rate and energy multiplication factor. These results are consistent with cold fusion experiments. On the basis of a simple model it is conjectured that necessary electric potential difference to accelerate particles can be generated even in a metal crystal with rather low resistivity, and we conclude that the fracto-fusion mechanism can explain the cold fusion phenomena successfully. (author).

4157 (JAERI-M–89-129) **Activation cross section data file.** Yamamuro, Nobuhiro; Iijima, Shungo. Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment. c 30 Aug 1989. 98p. (In Japanese). Sponsored by Japan Atomic Energy Research Institute. (NEANDC(J)–141/U;INDC(JPN)–128/L). Available from Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, 319-11, Japan.

To evaluate the radioisotope productions due to the neutron irradiation in fission or fusion reactors, the data for the activation cross sections ought to be provided. It is planning to file more than 2000 activation cross sections at final. In the current year, the neutron cross sections for 14 elements from Ni to W have been calculated and evaluated in the energy range 10^{-5} to 20 MeV. The calculations with a simplified-input nuclear cross section calculation system SINCROS were described, and another method of evaluation which is consistent with JENDL-3 were also mentioned. The results of cross section calculation are in good agreement with experimental data and they were stored in the file 8, 9 and 10 of ENDF/B format.

4158 (JINR-E–6-89-411) **Second class currents and the β-particle asymmetry at the decay of oriented ^{24m}Na nuclei.** Cathat, C.L.; Solnyshkin, A.A.; Ousmane, M.A. Joint Inst. for Nuclear Research, Dubna (USSR). 1989. 11p. (CONF-8904280–2: International conference on electromagnetic transitions in atomic nuclei, Tashkent (USSR), 18-21 Apr 1989). Order Number DE90000717. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

The possible contribution of second class currents to the β-particle asymmetry coefficient (A_e) at the decay of oriented ^{24m}Na nuclei is theoretically investigated and estimated in the framework of the nuclear shell model. For $F_T \approx 10^{-3}$ MeV^{-1} the effect is shown to be $\approx 10^{-3}$. A possibility of an experiment to measure the energy dependence of the coefficient A_e using the laser method is discussed. A scheme of the experiment is proposed. 12 refs.

4159 (KURRI-TR–315) **Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1988.** Nakagome, Yoshihiro (ed.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Feb 1989. 115p. (In Japanese). (CONF-8812116–: Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan), 19 Dec 1988). Order Number DE90719706. Available from NTIS (US Sales Only), PC A06/MF A01.

The meeting was held on Aug. 10 and Dec. 19, 1988. The proceedings carry a total of 13 reports concerning the physics and engineerings of fission and spallation. The first and second reports, entitled 'IAEA Consultant's Meeting on the Physics of Neutron Emission in Fission (I) and (II)', respectively, give brief comments on major topics discussed in the meeting, recently obtained information, and issues of physical interest in the field of fission and spallation. The other 11 reports are entitled 'A Study on Mass Division in Low-Energy Nuclear Fission', 'Recent Topics on The Nuclear Fission Accompanied with High Spin', 'Nuclear Spallation Engineering and Strong Neutron Source', 'Nuclear Spallation by Gamma-Rays', 'Comment: Photopion Reaction and Photospallation', 'Report on the International Meeting on Physics and Chemistry of Nuclear Fission in Commemoration of the 50th Anniversary of the Discovery of Nuclear Fission', 'Charge Distribution and Neutron Systematics in Heavy-Ion Fission', 'High-Energy Gamma-Rays from Fission of ^{252}Cf', 'Behavior of FP in Chromatographic Separation', 'Formation of Neutron by Light Ion', and 'Annihilation Treatment and Annihilation Furnace Equipped with Proton Accelerator'. (N.K.).

4160 (LA-UR–89-3638) **Pion induced double-charge exchange above the resonance.** Oset, E.; Strottman, D. Los Alamos National Lab., NM (USA). 24 Oct 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8908131–3: 2. LAMPF workshop on pion-nucleus double charge exchange, Los Alamos, NM (USA), 9-11 Aug 1989). Order Number DE90002656. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The zero degree excitation function for (π^+, π^-) is calculated for pion energies of 300 to 1400 MeV assuming a sequential mechanism. The cross section around 1225 MeV is 10^4 smaller than at 800 MeV. Experiments at this energy should be ideal for searches for effects due to exchange currents, and other non-conventional mechanisms. 15 refs.

4161 (LBL–27874) **Looking for precursors of neutron matter exotica.** Myers, W.D. Lawrence Berkeley Lab., CA (USA). Oct 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-891030–2: AIAA computers in aerospace conference, Monterey, CA (USA), Oct 1989). Order Number DE90003109. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The question of the possible stability of neutron matter is investigated within the framework of a Thomas-Fermi model of nuclei. Some of the consequences of bound (or slightly unbound) neutron matter are discussed. A comparison is then made between the model predictions and the observed neutron drip line for light nuclei. The tentative conclusion arising from this comparison is that neutron matter is probably unbound, in approximate agreement with an earlier theoretical estimate. Quantum effects that could lead to extremely large neutron halos are also briefly discussed. 11 refs., 7 figs.

4162 (LBL–27881) **Theoretical issues in the search for the quark gluon plasma.** Gyulassy, M. Lawrence Berkeley Lab., CA (USA). Oct 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890826–7: International nuclear physics conference, Sao Paulo (Brazil), 20-26 Aug 1989). Order Number DE90003272. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Issues connected with independent string fragmentation, initial conditions, and hadronic transport in light ion reactions at AGS and SPS are discussed. 19 refs., 2 figs.

4163 (N–89-27477) **Nuclear fragmentation energy and momentum transfer distributions in relativistic heavy-ion collisions. Progress report, period ended 30 June 1989.** Khandelwal, G.S.; Khan, F. Old Dominion Univ., Norfolk, VA (USA). Aug 1989. 152p. (NASA-CR–185501;NAS–1.26:185501). Available from NTIS, PC A08/MF A01.

An optical model description of energy and momentum transfer in relativistic heavy-ion collisions, based upon composite particle multiple scattering theory, is presented. Transverse and longitudinal momentum transfers to the projectile are shown to arise from the real and absorptive part of the optical potential, respectively. Comparisons of fragment momentum distribution observables with experiments are made and trends outlined based on our knowledge of the underlying nucleon-nucleon interaction. Corrections to the above calculations are discussed. Finally, use of the model as a tool for estimating collision impact parameters is indicated.

4164 (RCNP-P–105) **Proceedings of the workshop on neutron scattering and neutron reactions.** Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Jul 1989. 121p. Order Number DE90705941. Available from NTIS (US Sales Only), PC A06/MF A01.

Individual papers in these proceedings are indexed separately.

4165 (RCNP-P–105, pp. 80-89) **Semiclassical distorted wave theory of inclusive nucleon inelastic scattering to continuum.** Kawai, M. (Kyushu Univ., Fukuoka (Japan). Dept. of Physics); Luo, Y.L. Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Jul 1989. (In Japanese). In *Proceedings of the workshop on neutron scattering and neutron reactions.* Order Number DE90705941. Available from NTIS (US Sales Only), PC A06/MF A01.

A semiclassical model is presented for the one step process of the inclusive nucleon inelastic scattering to the continuum. In the model, we use distorted waves for describing the motion of the incident and the exit nucleon, and the Thomas-Fermi model for the initial and the final states of the target nucleus. The averaged two-body cross section inside the nucleus is given by Kikuchi-Kawai expression. The model gives a closed form formula for the double differential cross section. No free parameter is included. We apply the model to the inclusive nucleon inelastic scattering from Al, Sn and Bi at 62 MeV, and Ni at 164 MeV. The angular distribution experimental data are reproduced very well except for small and large angle regions. The calculated energy spectra agree with the experimental data very well in the middle angle region and at high exit energies. (author).

4166 Coulomb-nuclear interference in elastic heavy-ion scattering. Fricke, S.H. (Wisconsin Univ., Madison (USA). Dept. of Physics); Hatchell, P.J.; McVoy, K.W.; Satchler, G.R. *Nuclear Physics [Section] A (Netherlands)*, 500(2): 399-428 (21 Aug 1989). DOE Contract AC05-84OR21400.

Elastic heavy-ion angular distributions at small angles, forward of the quarter-point angle, have often been characterized as examples of either a Coulomb rainbow or of Fresnel diffraction. Using the modern high-quality data of Hostachy et al. as an example, we argue that the truth is intermediate between these two extremes, and indeed so far from them as to make both models quite inappropriate descriptions of nuclear reality. We suggest retreating to the more general label of 'Coulomb-nuclear interference', which includes both of these (inapplicable) extremes as special cases. A semiclassical analysis of optical-model fits is found to offer helpful insight into the nature of this interference. (orig.).

4167 Hadronization of the flux tubes in ultrarelativistic nucleus–nucleus collisions. Kataja, M. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (US)); Matsui, T. *Annals of Physics (New York) (USA)*, 192(2): 383-408 (Jun 1989).

The hadronization mechanism of flux tubes which may be created in relativistic heavy ion collisions is studied by introducing the concept of an intermediate mixed state in which fragmented flux tubes coexist with a dilute hadron gas. In the thermodynamic limit, this state can be considered a color dielectric medium characterized by a color dielectric constant which takes values between 0 and 1. The electrohydrodynamics formulated previously to describe plasma formation by the decay of a strong color electric field in the flux tube is extended to incorporate such a dielectric nature of transient hadronic matter using the bag model. It is shown that in the limit of the large bag constant our formalism is reduced to the hydrodynamics of the hadron gas produced by the fragmentation of multiple strings. We present a numerical simulation of one-dimensional longitudinal evolution of the system which demonstrates the characteristic reheating effect due to the hadronization transition. © 1989 Academic Press, Inc.

4168 Correlations between fragment mass and excitation energy in damped reactions. Toke, J. (Department of Chemistry, University of Rochester, Rochester, New York 14627 (US)); Schroder, W.U.; Huizenga, J.R. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(4): 1577-1580 (Oct 1989).

A recent claim of significant correlations between the fragment mass and excitation energy at a fixed total kinetic energy loss in a damped reaction is reexamined. It is shown that correlations of similar character and strength to those reported, result from incorrect assumptions made in the original analysis of kinematical coincidence data from the $^{165}Ho+^{56}Fe$ reaction at 504 MeV. Based on Monte Carlo simulations of the experiment, it is concluded, that within the uncertainties resulting from the experimental method, the data from the above reaction are consistent with a damped reaction mechanism, in which, for a fixed kinetic energy loss, the fragment excitation energy is uncorrelated with its mass.

4169 Cold nuclear fusion in metallic hydrogen and normal metals. Horowitz, C.J. (Physics Department and Nuclear Theory Center, Indiana University, Bloomington, Indiana 47405 (US)). *Physical Review [Section] C: Nuclear Physics (USA)*, 40(4): 1555-1558 (Oct 1989).

The rate of nuclear fusion from tunneling in very dense metallic hydrogen in the core of Jupiter is calculated to be 10^{-50} per hydrogen-deuterium pair per second. It is estimated that the width of the fusion barrier for deuterium in palladium or a similar metal must be reduced to, of order, 0.1 A for the fusion rate to be 10^{-25} per deuterium per second. If this scale is achieved, the ratios of various nuclear reaction rates will be very different for cold versus thermonuclear fusion.

4170 Dirac random-phase-approximation analysis of the inelastic scattering of 500 MeV protons from ^{40}Ca. Rost, E. (Department of Physics, University of Colorado, Boulder, Colorado 80309 (US)); Shepard, J.R. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(4): 1736-1740 (Oct 1989).

The random-phase-approximation description of nuclear excitations is applied to the calculation of inelastic scattering of 500 MeV protons from ^{40}Ca at 500 MeV. The calculations are based on a relativistic mean-field theory applied in a consistent manner for bound and continuum states in a distorted-wave impulse approximation. Differences in spin observables between our random-phase-approximation treatment and collective model treatments are traceable to ΔS=1 terms included in the random-phase approximation. Agreement with data is somewhat better using the random-phase-approximation approach.

4171 Boltzmann-Uehling-Uhlenbeck and relaxation time methods: A comparison. Kohler, H.S. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, Berkeley, California 94720 (US)); Bauer, W. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(4): 1711-1715 (Oct 1989). DOE Contract AC03-76SF00098.

The Boltzmann-Uehling-Uhlenbeck and relaxation time methods are compared numerically for collisions between two ^{16}O nuclei. Phase-space trajectories and double differential cross sections for nucleon emission are compared. Results are practically identical although the relaxation time method exhibits a slightly higher degree of stopping power.

4172 Saturation effects in gamma-band energies. Casten, R.F. (Brookhaven National Laboratory, Upton, New York 11973 (US)); Heyde, K.; Wolf, A.; von Brentano, P. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(4): 1806-1809 (Oct 1989). DOE Contract AC02-76CH00016.

It is shown that a recently proposed method that reproduces the saturation in $B(E2;0_1^+ \rightarrow 2_1^+)$ values in deformed nuclei also improves interacting boson model predictions for γ-band energy systematics near midshell. The method is based on an explicit recognition of the (Nilsson) orbit dependence of the valence p-n interaction and is, in effect, a refinement to the N_pN_n scheme which linearizes the behavior of certain observables.

4173 Role of mesonic resonances in antiproton annihilation on nuclei. Cugnon, J. (Physique Nucleaire Theorique, Institut de Physique au Sart Tilman, Universite de Liege, B-4000 Liege 1, Belgium (BE)); Deneye, P.; Vandermeulen, J. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(4): 1822-1825 (Oct 1989).

The implications of η and ω production in antiproton-nucleus annihilation are examined by means of a simplified cascade scheme. The intranuclear absorption of the pions "hidden" in the resonances is predicted smaller than the average pion absorption measured by experiment. It is also pointed out that the reaction $\omega N \rightarrow \Lambda K$ might be a significant source of Λ production in antiproton-nucleus interactions. The possibility of studying η-nucleus interactions is examined.

4174 Single-particle spectrum and ring-diagram nuclear matter calculations: A reply to a Comment. Jiang, M.F. (Department of Physics, University of Idaho, Moscow, ID (USA)); Kuo, T.T.S.; Muther, H. *Physical Review [Section] C: Nuclear Physics (USA)*, 40(4): 1836-1838 (Oct 1989).

Ring-diagram nuclear matter calculations using different choices for the single-particle spectrum are performed and discussed.

4175 Fusion rates for hydrogen isotopic molecules of relevance for "cold fusion". Szalewicz, K. (Department of Physics and Astronomy, University of Delaware, Newark, Delaware 19716 (US)); Morgan, J.D. III; Monkhorst, H.J. *Physical Review [Section] A: General Physics (USA)*, 40(5): 2824-2827 (1 Sep 1989).

In response to the recent announcements of evidence for room-temperature fusion in the electrolysis of D_2O, we have analyzed how the fusion rate depends on the reduced mass of the fusing nuclei, the effective mass of a "heavy" electron, and the degree of vibrational excitation. Our results have been obtained both by accurately solving the Schroedinger equation for the hydrogen molecule and by using the WKB approximation. We find that in light of the reported *d-d* fusion rate, the excess heat in the experiment by Fleischmann, Pons, and Hawkins [J. Electroanal. Chem. 261, 301 (1989)] is difficult to explain in terms of conventional nuclear processes.

4176 **Feynman–Monte Carlo calculations of electron capture at relativistic collider energies.** Rhoades-Brown, M.J. (Accelerator Development Department, Brookhaven National Laboratory, Upton, New York 11973 (US)); Bottcher, C.; Strayer, M.R. *Physical Review [Section] A: General Physics (USA),* 40(5): 2831-2834 (1 Sep 1989). DOE Contract AC02-76CH00016;AC05-84OR21400.

Calculations are presented for electron capture associated with pair production in collisions of heavy ions at relativistic energies. We employ the recently introduced technique of evaluating Feynman perturbation integrals exactly by Monte Carlo methods. The results agree well with virtual-photon approximations if they are carefully formulated, but appear to disagree with some published results. The cross sections for symmetric collisions of uranium, gold, iodine, copper, and silicon are presented as a function of the beam energy. These results are discussed within the context of beam storage times of a relativistic heavy-ion collider.

4177 **Muon spectrum and convoy effects after muon-catalyzed fusion.** Muller, B. (Department of Physics, University of Arizona, Tucson, Arizona 85721 (US)); Rafelski, H.E.; Rafelski, J. *Physical Review [Section] A: General Physics (USA),* 40(5): 2839-2842 (1 Sep 1989).

We study final-state interactions of the muon after muon-catalyzed D-T fusion reaction with the α particle and with target matter. The yield of convoy muons, traveling with the α particle but remaining unbound is calculated. Energy loss in the dense target may lead to capture of a fraction of these muons into outer shells of the α particle. We show that the final capture probability can be strongly density dependent.

6540 Radiation and Shielding Physics

Refer also to citation(s) 2474, 4416

4178 (AD-A–210999/9/XAB) **Radiation-transport calculations of a simple structure using the vehicle code system with 69-group cross sections and the Monte Carlo neutron and photon code. Final report.** Caton, H. Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab. Aug 1989. 17p. (BRL-TR–3025). Available from NTIS, PC A03/MF A01.

The 58-Group Cross Sections used in vehicle code system (VCS) calculations do not adequately describe secondary gamma production in steel. In response, Oak Ridge National Laboratory (ORNL) has compiled a set of cross sections with 69 energy groups. This report documents an escalation of the 69-group cross sections on a simple steel box with various radiation liners. Also evaluated is the Monte Carlo Neutron and Photon Transport Code (MPNP).

4179 (INDC(NDS)–224/GF) **Translation of reports from the first international conference on neutron physics, Kiev, USSR, 14-18 September 1987.** International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. 12p. (CONF-870959–: 1. international conference on neutron physics, Kiev (USSR), 14-18 Sep 1987). Order Number DE90607655. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Translated from Russian by the IAEA.

The document contains the English translation of the following two papers presented at the First International Conference on Neutron Physics, held in Kiev, USSR, between 14-18 September 1987: Neutron Leakages from Pb and Be Spherical Shells with a Central 14-MeV Neutron Source; Integral Experiments on Transmission of 14-Mev Neutrons in a FLiBe Assembly. A separate abstract was prepared for each of these papers. Refs and tabs.

4180 (INIS-BR–1683) **Determination of X-ray anomalous scattering in silicon.** Cusatis, C. Parana Univ., Curitiba, PR (Brazil). Dept. de Fisica. 1987. 78p. (In Portuguese). Order Number DE90607662. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The linear attenuation coeficient for X-ray in silicon was measured with approximately 0,1% accuracy, for 6 diferent wavelenghts of caracteristic radiation. From these result the imaginary parts of the atomic scattering factors, for silicon and for those wavelenghts, were obtained with the same accuracy. The results are compared with the most recent published values. The proposed method to avoid Rayleigh scattering can be used for any type of "perfect" crystal. (author).

4181 **Symbolic implicit Monte Carlo.** Brooks, E.D. III (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550 (US)). *Journal of Computational Physics (USA),* 83(2): 433-446 (Aug 1989). DOE Contract W-7405-ENG-48.

We introduce a new implicit Monte Carlo technique for solving time dependent radiation transport problems involving spontaneous emission. In the usual implicit Monte Carlo procedure an effective scattering term in dictated by the requirement of self-consistency between the transport and implicitly differenced atomic populations equations. The effective scattering term, a source of inefficiency for optically thick problems, becomes an impasse for problems with gain where its sign is negative. In our new technique the effective scattering term does not occur and the excecution time for the Monte Carlo portion of the algorithm is independent of opacity. We compare the performance and accuracy of the new symbolic implicit Monte Carlo technique to the usual effective scattering technique for the time dependent description of a two-level system in slab geometry. We also examine the possibility of effectively exploiting multiprocessors on the algorithm, obtaining supercomputer performance using shared memory multiprocessors based on cheap commodity microprocessor technology. © 1989 Academic Press, Inc.

4182 **Intense microwave radiation from a repetitive backward-wave oscillator driven by a relativistic electron beam.** Bromborsky, A. (Harry Diamond Laboratories, 2800 Powder Mill Rd., Adelphi, Maryland 20783-1145 (US)); Still, G.W.; Kehs, R.A.; Clark, C.; Early, L.; Rohwein, G.; Poukey, J. *Journal of Applied Physics (USA),* 66(8): 3871-3876 (15 Oct 1989).

High-power microwaves (20–50 MW, 8.8 GHz) have been produced in repetitive pulses at a rate of 10 Hz in a joint experiment by Harry Diamond Laboratories and Sandia National Laboratories. These microwaves were produced with Harry Diamond Laboratories' backward-wave oscillator (BWO), driven by a 600 to 800-kV, 2-kA electron beam, which was guided by a magnetic field of variable strength from 0.75 to 1.05 T. The beam was produced with Sandia National Laboratories' repetitive high-voltage pulser, RAVEN. Microwave diagnostic instrumentation included a directional coupler, heterodyne receiver, dispersive waveguide delay line, and calorimeter. In a train of 10 pulses, the shape, duration, and amplitude of the injection voltage and beam current remained unchanged for each individual pulse. The intensity of the final microwave pulse was 40% of the first pulse, and the final pulse was 80% as long as the first. The basic pulse shape remained unchanged. More intense microwave radiation should be obtained with a higher magnetic field. Computer simulations using the code magic predicted the characteristic dip in the magnetic field strength versus microwave power output curve. Code predictions of microwave power output with a warm beam agree very well with experimental results. Finally, cyclotron resonance is presented in a descriptive fashion to account for the power output dip. This is the first experiment with a repetitively pulsed high-power BWO driven by a relativistic electron beam performed outside the USSR.

6550 Medical Physics

Refer also to citation(s) 2487, 2499, 3505

4183 (BARC–1453) **Environmental radiation levels in and around Kalpakkam during 1983-1987.** Nambi, K.S.V.; Mehta, N.K.; Kannan, V.; Sundaram, Meenakshi; Viswambharan, K.R.

Bhabha Atomic Research Centre, Bombay (India). 1989. 38p. Order Number DE90608340. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Results of the environmental radiation monitoring around the Kalpakkam Atomic Power Station carried out routinely on quarterly integrating cycles using thermoluminescent dosimeters, are presented and analysed, for the five year period 1983-87. As the first reactor attained criticality in July 1983 and the second unit in August 1985 the results are compared with the previously published values for the period 1980-82. Only at two locations viz. the Micromet laboratory situated at 800 meters from the station and the main gate located at the 1.6 km exclusion zone boundary, a possible indication of increases in the environmental radiation level associated with the power reactor operations could be discerned. However these were found to be statistically insignificant. The whole terrain is characterised by somewhat high levels of terrestrial radiations with quite wide temporal fluctuations which easily mask the small increases if any in the radiation levels, contributed by the reactors. Places located farther away from the power station and away from the monazite-bearing beaches, yielded an annual average background level of 117 +- 29 mR as against the value of 125 +- 24 mR obtained during the preoperational period of 1980-82. A declining general trend in the radiation levels is seen at many locations and this is thought to be associated with significant reduction in the ^{137}Cs fallout component of the environmental radiation. (author). 5 refs., 2 tabs., 11 figs.

4184 (CEA-R-5492) **Ionizing radiations dosimetry: new results in the megagray range.** Balian, P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires. 1989. 154p. (In French). Order Number DE90721224. Available from NTIS (US Sales Only), PC A08/MF A01.

Industrial irradiation for food preservation, medical sterilization and plastic processing is in great expansion and an accurate dosimetry in the megagray range is required. It is also required for safety purposes around nuclear reactors or waste storage sites. The study of photon-matter interaction leads us to consider high-dose dosimeters among the solids in which radiolysis occurs. Organic conductors are indeed good candidates for high-dose dosimetry. These materials show original properties due to the great anisotropy of their electronic system. Radiation effects, especially on the resistivity and on the (E.S.R.) Electron Spin Resonance linewidth, are very important. We show that a simple resistance measurement allows an accurate monitoring of the absorbed dose, in the range 0.01 - 50 MGy, for X-rays, gamma-rays and electron irradiations. The E.S.R. linewidth measurements permits the use of small dosimeters between 1 and 100 MGy. Finally, some organic conductors are proposed as high-temperature dosimeters for irradiation performed up to 120^{0}C. The irradiated pure silica contains a large variety of defects. Only the E' center seems helpful for dosimetry purposes, and its electron spin resonance (E.S.R.) signal is simply related to the absorbed dose in the range 0.1 - 3 MGy or even, 0.5 kGy - 5 MGy.

4185 (CONF-890619-9) **Light sensitivity of .13 mm thick LiF-teflon thermoluminesence dosimeters.** Adams, F.D.; Crawford-Brown, D.J.; Watson, J.E.; Symons, M.J.; Hamrick, P.E. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA). [1989]. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-89NV10630. From 34. annual meeting of the Health Physics Society; Albuquerque, NM (USA); 25-29 Jun 1989. Order Number DE90002509. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Based on the results of this study, it is recommended that before a dosimeter is put to use for radiation exposures it should be placed in a controlled environment. The environment should have the same type and duration of light exposure that is used in the laboratories and/or other setting where the dosimeter will be used, with no ionizing radiation source present. The dosimeter should be exposed to this environment for the same amount of time that the dosimeter will be used in dose assessment. The TLDs that were exposed to the fluorescent light should then be read and and the results compared to the light output of the TLDs that have been read for background. If the exposed TLD's response is higher than background readings then the covering of the TLDs should be checked for lighttightness. This is very important since doses can be overestimated if this aspect is not taken into account.

4186 (INIS-BR-1688) **Radiological survey of Goiania by a mobile monitoring unit.** Moreira, M.C.F. Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil). [1989]. 12p. Order Number DE90608341. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

After the initial response to the radiological accident in Goiania, a radiological survey throughout the city was performed using a mobile unit. This unit was equipped with two Geiger Muller detectors outsise the vehicle and one 4' x 4' NaI(Tl) detector connected to a dual recorder. All three detectors were placed 1 m above the ground. The survey system covers a wide range of exposure rate, since environmental levels up to 10 R h^{-1}. Eighty percent of the Goiania urban area was covered by this survey and except for some specific locations the contamination was restricted to the main foci surroundings ocurring in a non homogenous pattern. The highest value observed in the city after the main foci decontamination was of 0.7 mR h^{-1} in the 57th street - where the source was opened. Results of the main foci and some other locations are apresented in the paper. The system designed to perform the survey in the city played a fundamental role during the decontamination process (author).

4187 (INIS-BR-1719) **Aspects of radiological protection in nuclear installations.** Hunt, J.G.; Oliveira Filho, D.S.; Rabello, P.N.P. Instituto Brasileiro do Petroleo, Rio de Janeiro, RJ (Brazil). 1987. 10p. (In Portuguese). (CONF-8705395-: 5. seminar on industrial safety, Fortaleza (Brazil), 26-29 May 1987). Order Number DE90608344. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Due to the short term, long term and genetic effects of radiation, the work with radioactive materials requires special protection measures. The objective of radiological protection is to assure the occupational health of the workers by maintaining the dose levels as low as reasonably achievable. The radiological protection measures implanted in the NUCLEBRAS fuel element factory are described. The philosophy and practical measures taken are explained, and a comparison between radiation protection and industrial safety norms is made. The result of this work shows that the radiological safety of the element factory is assured. (author).

4188 (INIS-BR-1720) **Radiological protection. Responsibility of the Safety Engineering Company.** Netto, A.L. Instituto Brasileiro do Petroleo, Rio de Janeiro, RJ (Brazil). 1987. 6p. (In Portuguese). (CONF-8705395-: 5. Seminar on Industrial Safety, Fortaleza (Brazil), 26-29 May 1987). Order Number DE90608334. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

This subject takes care of the Safety Engineering at the Radiologic Protection area on the X and Gama Rays Services. It mainly emphasis the case of that companies that, due do not have proper X and Gama Rays Services utilize partime task force on this area, but answer themselves for the safety of their employees in case of any accident occurence. (author).

4189 (INIS-BR-1747) **Development of a mathematical phantom for a child with 10 years age for internal dosimetry.** Deus, S.F.; Watanabe, S. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. 1p. (In Portuguese). (CONF-8908184-: 3. Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). Order Number DE90608345. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. PHANTOMS/children; PHANTOMS/dosimetry; COMPARATIVE EVALUATIONS; NUCLEAR MEDICINE; PHANTOMS; CHILDREN; DOSIMETRY; RADIOISOTOPES

4190 (INIS-mf-11558) **Natural background radiation and population dose distribution in India.** Nambi, K.S.V.; Bapat, V.N.; David, M.; Sundaram, V.K.; Sunta, C.M.; Soman, S.D. Bhabha Atomic Research Centre, Bombay (India). 1986. 30p. Order Number DE90608346. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A country-wide survey of the outdoor natural background gamma radiation levels has been made using mailed thermoluminescent

dosimeters (TLDs). The salient features of the results are: (1) The air-kerma levels and the population doses in various states follow log-normal and normal distributions respectively. (2) The national average value for the air dose (air-kerma) is 775 +- 370 (1σ)μGy/y. (3) The lowest air-kerma recorded is 0.23 mGy/y at Minicoy (Laccadive Islands) and the highest is 26.73 mGy/y at Chavra (monazite areas, Kerala). (4) There are significant temporal variation s (even as high as +- 40 per cent) of the background radiation level at many locations and at least in 10 locations where radon/thoron measurements are available, these could be associated with the seasonal variations in radon/thoron levels. (5) The mail control TLDs indicate a country-wide average value of 785 +- 225 μGy/y for the air-kerma which can be considered to provide a truly national average value for the natural background radiation level in India. (6) The mean natural radiation per caput for the country works out to be 690 +- 200 (1σ) Sv/y. (7) The natural radiation per caput seems to be maximum for Andhra Pradesh (1065 +- 325 μSv/y) and minimum for Maharashtra (370 +- 80 μSv/y). (8) The population dose from the external natural background radiation is estimated to be half a million person-Sievert. (9) Assuming 1 CRP risk factor, it can be estimated that just one out of the 43 cancer deaths occurring on an average per 100,000 population in India, can be attributed to the external natural background radiation. (author). 18 refs., 13 tabs., 9 figs.

4191 (INIS-mf–11562) **Abstracts of 14th radiation hygiene days.** Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. 93p. (In Czech, Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The proceedings contain 90 abstracts of submitted papers and posters. All have been inputted in INIS. They concern radiation hygiene and radiation protection, this both in general terms and in terms of occupational hazards; they inform on natural radioactivity measurement; on radon levels in buildings; the assessment and monitoring of escapes of radioisotopes into the environment (especially following the Chernobyl nuclear power plant accident). The questions are discussed of building monitoring networks in the environs of nuclear power plants and radioactive waste burial sites. Some presentations deal with dose measurement and spectrum evaluation; the organisation of the national personnel dosimetry service; tests of radiopharmaceuticals purity and activity; dosimetry work during dismantle of a shutdown reactor; medical radiology risks; and other problems. (M.D.).

4192 (LHRL-LIB/Trans–3) **Dose limits.** Fitoussi, L. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Dec 1987. 34p. Order Number DE89618065. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Translated from CEA Clefs (Jul 1987) no. 6 p. 22-33.

The dose limit is defined to be the level of harmfulness which must not be exceeded, so that an activity can be exercised in a regular manner without running a risk unacceptable to man and the society. The paper examines the effects of radiation categorised into stochastic and non-stochastic. Dose limits for workers and the public are discussed.

4193 (NEANDC-E–292-U-Vol.III-Euratom) **Annual progress report on nuclear data 1987.** Hansen, H.H. (ed.). Nuclear Energy Agency, 75 - Paris (France). Nuclear Data Committee. Oct 1988. 57p. (INDC-EUR–022-G). Order Number DE90721238. Available from NTIS (US Sales Only), PC A04/MF A01.

In 1987 the efforts for the improvement of the set of standard neutron cross-sections, the mass-distributions in the fission of U^{235} continued. In the field of nuclear data for fission technology, effort was concentrated on subthermal neutron energy, Cr isotopes and Ni isotopes. In the area of nuclear data for fusion technology, data for neutron transport calculations in the blanket were improved. The radionuclide metrology works determined decay-scheme data and preparation of standards. A cooperation was established between INDC and CBNM for neutron flux metrology.

4194 (NIRS-R–15) **Report of radioactivity survey research in fiscal year 1987.** National Inst. of Radiological Sciences, Chiba (Japan). Dec 1988. 107p. (In Japanese). Order Number DE90719709. Available from NTIS (US Sales Only), PC A06/MF A01.

National Institute of Radiological Sciences has carried out continuously since 1959 the survey and research on the environmental radioactivity level due to the radioactive fallouts accompanying nuclear explosion experiments and the radioactive substances released from atomic energy facilities, as a part of the radioactivity survey and research performed by Science and Technology Agency. Now, accompanying the remarkable development of the peaceful utilization of atomic energy, the interest of people in environmental radioactivity has become high. Accordingly, the safety research in atomic energy utilization is strongly demanded, and the survey and research on radioactivity that is the base of the effect to environment and people become more important. In fiscal year 1987, the budget of more than 147 million yen was appropriated, and the survey of radioactivity level and dose in environment, foods and human bodies, the survey of level around atomic energy facilities, the business of the radioactivity data center, the basic investigation concerning the evaluation of the results of radioactivity survey, the training of technicians of environmental radiation monitoring and the survey and research on the measurement of and countermeasures to emergency exposure were carried out. These results are reported. (K.I.).

4195 (PNL–7124) **The determination of the penetrating radiation dose at Hanford.** Rathbun, L.A. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 24p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE90001780. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Most of the thermoluminescent dosimeters (TLDs) and other devices that have been used to measure environmental radiation on the Hanford Site have measured natural background levels of radiation. Measurements of offsite environmental radiation near the boundary of the Hanford Site have often indicated higher doses than onsite measurements have. However, the converse has been found when radiation measurements from the cities and communities of southeastern Washington were compared with onsite measurements. The historical trends described for environmental TLD data have been better defined in this study by compiling the TLD data for selected locations over a 6-year period (1983 to 1988). The ongoing Hanford Environmental Surveillance Program also provides radionuclide concentrations in soil based on samples collected by technicians at Pacific Northwest Laboratory (PNL) and sent to a commercial laboratory for analyses. As part of the study described in this report, a portable gamma spectroscopy system was used in the field to identify concentrations of gamma-emitting radionuclides in the soil at various locations on the Hanford Site and in the surrounding area. This work began in 1986. Supplemental radiation measurements were made with a microprocessor-based survey meter and large NaI detector. 20 refs., 4 figs., 3 tabs.

4196 (SAAS–372) **State control in the GDR of the handling of unsealed radioactive materials in laboratories of type I to III.** Goergner, D.; Makedanz, A.; Ott, R.; Poulheim, K.F. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 38p. (In German). Order Number DE90608331. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The legal requirements for the handling of unsealed radioactive materials have been explained in depth including such questions as how to get a State permission, build and equip Type-I, Type-II and Type-III laboratories, and monitor radiation workers at these working places. Finally, mention was made of the radionuclides most frequently handled as well as the overall activity processed per year in the different laboratories. (author).

4197 (SAAS–373) **Conduct of local dosimetry in X-ray diagnosis.** Anger, K. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 26p. (In German). Order Number DE90608335. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Local dosimetry represents a fundamental method of controlling the observance of technical radiation protection requirements for the

use of X-ray equipment. First measurements are already taken at an early stage, that is, following the manufacturing of radiological equipment. Further measurements are performed after installation, before putting into operation, after maintenance and repair work as well as during in-service inspections. Details of, including responsibilities for, these measurements are explained. (author).

4198 (SAAS–374) **Radiation protection measurements at a UA-type teaching kit of sealed radioactive sources.** Glaeser, M.; Makedanz, A. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 20p. (In German). Order Number DE90608336. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The radioactive teaching kit of type UA approved for use at secondary schools in the GDR contains Co-60, Cs-137, Na-22 and Kr-85. Dose rate measurements around the loaded source container as well as around the unshielded individual sources indicated that the radiation exposure to experimenters and audiences from this kit can be considered negligibly small, provided the sources are handled properly. (author).

4199 (SAAS–375) **Experience in the use of the UA-type teaching kit of sealed radioactive sources.** Makedanz, A.; Glaeser, M. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 18p. (In German). Order Number DE90608337. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The radioactive teaching kit of type UA approved for use at secondary schools in the GDR contains Co-60, Cs-137, Na-22 and Kr-85. The experiences gained with this kit during more than 15 years are reported from the radiation protection point of view, covering such topics as technical and organizational radiation protection, radiation exposure to teachers and pupils while performing experiments as well as the dangers involved in unauthorized use of the radiation sources. (author).

6560 Condensed Matter Physics

Refer also to citation(s) 2317, 2824, 2890, 2908, 2934, 3076, 3221, 3264, 3887, 3906, 4253, 4273

4200 (AD-A–210741/5/XAB) **Dynamically compressed metals - theory. Final report, 1 February 1986-30 April 1989.** Ashcroft, N.W. Cornell Univ., Ithaca, NY (USA). Lab. for Atomic and Solid State Physics. 28 Jun 1989. 7p. Available from NTIS, PC A02/MF A01.

The major theme of this research concerns the physics of systems that are subjected to conditions typical of shock or explosive environments. The focus is mainly but not exclusively on metallic systems; under shock loading they usually acquire a very substantial increase in temperature. In fact, for nuclear driven shocks the temperatures can become significant compared even with the Fermi temperature, and the systems are then taken quite far from degeneracy. Central to the theory of any metallic system is the physics of the underlying electron gas; what is required is a theory capable to giving its thermodynamic functions over a range spanning the extreme quantum to classical limits. Such a theory has been developed and under the present grant has been applied to nearly free electron metallic systems. The major results of this research is the presentation of a unified theory that describes both the thermodynamic and dielectric properties of an interacting electron fluid throughout the full range of thermal degeneracy, that is, from the ground state (a degenerate Fermi plasma) to the classical domain where the system becomes a prototypical one-component plasma. In this work, were results obtained that are quite accurate up to significantly large values of the coupling strength characteristic of the system. Furthermore, closed-form parametrizations are provided, both of the thermodynamic functions and of the dielectric response function of the electron gas. These results, in parameterized forms, should be widely beneficial to a wide class of problems involving shocked metals.

4201 (AD-A–211119/3/XAB) **Nuclear magnetic resonance imaging as a tool to characterize defect densities in solids.** Suits, B.H.; Lutz, J.L. Michigan Technological Univ., Houghton, MI (USA). 1 May 1989. 4p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 65, No. 9, 3728-3730(1 May 1989).

Nuclear Magnetic Resonance imaging methods demonstrate the spatial variation of ^{23}Na signal intensity in NaCl which results from an impact-induced inhomogeneous defect distribution.

4202 (AD-A–211124/3/XAB) **Nuclear magnetic resonance in molten salts.** Wilkes, J.S. Frank J. Seiler Research Lab., United States Air Force Academy, CO (USA). 1987. 21p. (FJSRL-JR–87-0012). Available from NTIS, PC A03/MF A01.

Pub. in Molten Salt Chemistry, 217-236(1987).

Nuclear magnetic resonance (NMR) spectroscopy provides information about the structure of molten salts and about interactions among molten-salt components. This contribution reviews the application of NMR spectroscopy to molten salts done in this laboratory and by others. The fundamentals of the NMR method are presented, with emphasis on aspects particularly useful to molten salt samples. The limitations to the method resulting from the nature of molten salts and nuclei encountered are discussed. Examples of the types of information about molten salts provided by NMR experiments that are useful to chemists are presented. Chloroaluminate molten salts are the primary melt system used to illustrate the usefulness of NMR spectroscopy. Experiments in organic melts and the use of Thallium 205 as a probe in nitrates and halides are also treated.

4203 (ANL/PPRNT–89-190) **Dislocation-hydrogen correlation in metals.** Summerfield, G.C.; King, J.S.; Heuser, B.; Epperson, J.E. Argonne National Lab., IL (USA). Nov 1987. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90003005. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We present a method using SANS experiments to measure correlation between dislocations and absorbed hydrogen in metals. The technique involves sequential measurements first on a metal with dislocation networks, then two further measurements on the same sample infused with deuterium and normal hydrogen. SANS experiments on metals with dislocations networks have been performed a number of times and some results have appeared in the literature. We have computer estimates of the contribution of absorbed hydrogen and deuterium to SANS cross sections. The results show that we can expect to see the hydrogen contribution in the SANS cross section and see any possible correlations of the hydrogen positions and the dislocations. 8 refs., 2 figs., 2 tabs.

4204 (BNL–43345) **The initial scientific program at the NSLS infrared beamline.** Williams, G.P. Brookhaven National Lab., Upton, NY (USA). [1989]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890802–15: 7. synchrotron radiation instrumentation (SRI) national conference, Berkeley, CA (USA), 6-10 Aug 1989). Order Number DE90002299. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Unique extraction optics (90 x 90 mrads) at the NSLS U4IR line offer high brightness beams at up to mm wavelengths with a ~1ns pulse structure. Radiation from this port has now been carefully characterized and agrees well with calculations, making it 100–1000 times brighter than conventional sources in the middle and far infrared regions. Using rapid scan Michelson interferometers with liquid He cooled bolometer detectors we have been able for the first time to measure molecule substrate vibrations in surface science. We have also made the first measurements of the transmission of a film of the high Tc material YBaCuO in the BCS gap region. These initial experiments have demonstrated the advantages of the superior signal to noise available from this infrared beamline. 19 refs., 6 figs.

4205 (CONF-890821–6) **Stopping power and energy loss cross section of a point charge penetrating through a dense medium of bound electrons.** Belkacem, A.; Sigmund, P. Argonne National Lab., IL (USA). [1989]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. international conference on atomic collisions in solids; Aarhus (Denmark); 7-11 Aug 1989. Order Number DE90002841. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have derived the dielectric function $\epsilon(k,\omega)$ in the Lindhard approximation for a medium consisting of electrons individually bound by harmonic forces. The dielectric function is expressible in terms of

a hypergeometric series and approaches well-known results in the limits of negligible binding, large momentum transfer, and long wavelength, respectively. The stopping power of a moving point charge scales very well with the shifted resonance frequency $\omega_0 = (\omega_O^2 + \omega_P^2)^{1/2}$ (ω_O = oscillator frequency; ω_P = plasma frequency) that follows from classical dispersion theory. The results differ noticeably from free-electron behavior even at rather high electron density. The discrete excitation levels of an isolated harmonic oscillator are increasingly shifted and broadened with increasing electron density. 15 refs., 2 figs.

4206 (CONF-8904290–2) **Characterization of nanophase materials by x-ray diffraction and computer simulation.** Eastman, J.A.; Thompson, L.J. Argonne National Lab., IL (USA). Jun 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium J: interfaces between polymers, metals and ceramics; San Diego, CA (USA); 24-29 Apr 1989. Order Number DE90002270. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

X-ray diffraction experiments on nanophase Pd have been performed with the primary goal of determining the nature of grain boundary structures in nanophase materials. A kinematical diffraction analysis has been developed to interpret x-ray θ–2θ data by comparing actual scans with scans produced by computer simulation. This simulation program has been used to explore the effects on diffracted intensity of a variety of microstructural and grain boundary structural parameters such as void concentration, grain size, grain boundary width, and changes in interplanar spacing and density in grain boundary regions. It has been found that a reasonable match to experimental data is produced by at least two model structures; in one, the material contains randomly positioned voids or vacancies, while in the other, the interplanar spacings in grain boundary regions are varied with respect to the spacings found in the grain interiors. 7 refs., 4 figs.

4207 (CONF-8904290–3) **Atomic matching across internal interfaces.** Merkle, K.L. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium J: interfaces between polymers, metals and ceramics; San Diego, CA (USA); 24-29 Apr 1989. Order Number DE90002266. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The atomic structure of internal interfaces in dense-packed systems has been investigated by high-resolution electron microscopy (HREM). Similarities between the atomic relaxations in heterophase interfaces and certain large-angle grain boundaries have been observed. In both types of interfaces localization of misfit leads to regions of good atomic matching within the interface separated by misfit dislocation-like defects. It appears that, whenever possible, the GB structures assume configurations in which the atomic coordination is not too much different from the ideal lattice. It is suggested that these kinds of relaxations primarily occur whenever the translational periods along the GB are large or when the interatomic distances are incommensurate. Incorporation of low index planes into the GB appears to lead to preferred, i.e. low energy structures, that can be quite dense with good atomic matching across a large fraction of the interface. 20 refs., 9 figs.

4208 (CONF-8908133–6) **Dynamic simulation of mixed quantum-classical systems.** Kalia, R.K.; Vashishta, P.; De Leeuw, S.W.; Harris, J. Argonne National Lab., IL (USA). Sep 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 24. Yamada conference on strongly coupled plasma physics; Tokyo (Japan); 29 Aug - 2 sep 1989. Order Number DE90002172. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We discuss the simulation of mixed systems with quantum and classical particles based on the quantum molecular dynamics method. This technique is applied to the problem of an excess electron in a dense helium gas. The formation of an electron bubble and the results for the structure and dynamics of the bubble are discussed. 14 refs., 3 figs.

4209 (CONF-8910276–1) **Velocity distribution of laser photoionized neutrals ejected from methanol-dosed aluminium(111) by electron-stimulated desorption.** Young, C.E.; Whitten, J.E.; Pellin, M.J.; Gruen, D.M.; Jones, P.L. Argonne National Lab., IL (USA). 1989. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 4. international workshop on desorption induced by electronic transitions; Gloggnitz (Austria); 2-4 Oct 1989. Order Number DE90001938. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Nonresonant multiphoton ionization at 193 nm wavelength was employed for efficient detection of electron-stimulated neutral desorption from Al(111) dosed with methanol to produce monolayer methoxide coverage. Velocity spectra were measured by the flight time from the crystal surface to the focal region of the laser beam with a pulsed primary electron beam of 3 keV and the sample at 300 K. Either the C^+ or HCO^+ photofragment indicated the same non-Boltzmann velocity spectrum for the neutral parent precursor with a peak kinetic energy of ~0.1 eV. Identical distributions were obtained when the cleaned crystal was pre-oxidized with O_2 prior to methanol dosing. As the crystal temperature was raised, photoion signal from the HCO^+ fragment declined steadily, while C^+ increased until ~550 K. The total cross section for loss of parent signal with dose of 3 keV electrons was measured to be $2\pm1 \times 10^{-17}cm^{-2}$. 19 refs., 4 figs.

4210 (CONF-8911109–1) **Interactions of fast atomic and molecular ions with matter.** Belkacem, A.; Kanter, E.P.; Vager, Z. Argonne National Lab., IL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 10. DOE Atomic Physics Program workshop; Berkeley, CA (USA); 8-9 Nov 1989. Order Number DE90001906. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Argonne's 5-MV Dynamitron accelerator is used to study the interactions of fast (MeV) atomic and molecular ions with matter. A unique feature of the apparatus is the exceptionally high resolution, in angle and time-of-flight, obtained in detecting particles emerging from the target. New imaging detector systems have been developed which allow detection of multiparticle events consisting of up to 12 particles. The work has as its main objective a general study of the interactions of fast charged particles with matter, but with the emphasis on those aspects that take advantage of the unique features inherent in employing molecular-ion beams (e.g., the feature that each molecular ion incident upon a solid target forms a tight cluster of atomic ions that remain correlated in space and time as they penetrate the target). In particular, these techniques have allowed the direct determination of the geometrical structures of the molecular ions entering the target, providing the first direct measure of the fully correlated nuclear densities within small molecules.

4211 (DOE/ER/13632–3) **Molecular dynamics studies of aromatic hydrocarbon liquids: Progress report, March 1, 1989–February 28, 1990.** Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Chemical Engineering. [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER13632. Order Number DE90002705. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This report discusses the equation of state for fluids of rigid molecules and modeling of molecular flexibility. (LSP)

4212 (DOE/ER/45199–T2) **[Gamma scattering in condensed matter with high intensity Moessbauer radiation]: Progress report.** Purdue Research Foundation, Lafayette, IN (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER45199;FG02-85ER45200. Order Number DE90002524. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

There are four areas where major progress has occurred this year. We have applied the Fourier-transform method of describing and analyzing Moessbauer effect (ME) line shapes to make measurements of the temperature dependence of the recoilless fraction in tungsten. We have carried out quasi-elastic measurements of the gamma scattering from viscous liquids, learning about diffusive motion in polydimethylsiloxane, pentadecane, and glycerol. We have made major progress in fundamental physics, having shown for the first time how to determine precise quantum interference parameters, obtaining experimental results on the 46.5 keV line of ^{183}W and the 129 keV line of ^{191}Ir. Finally, we have continued our development of MICE detectors, with a theoretical analysis of the MICE lineshape and its relation to the lineshape of conventional transmission ME spectroscopy. 12 refs.

4213 (IC–89/101) **Irreversibility and self-organization in spin glasses. 1. Origin of irreversibility in spin glasses.** Kovrov, V.P.; Kurbatov, A.M. International Centre for Theoretical Physics, Trieste (Italy). May 1989. 20p. Order Number DE90607231. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The origin of irreversibility in spin glasses is found out on the basis of the analytical study of the well-known TAP equations. Connection between irreversible jumpwise transitions and a positive feedback in spin glasses is discussed. (author). 7 refs, 4 figs.

4214 (IC–89/102) **Irreversibility and self-organization in spin glasses. 2. Irreversibility and the problem of configuration averaging.** Kovrov, V.P.; Kurbatov, A.M. International Centre for Theoretical Physics, Trieste (Italy). May 1989. 27p. Order Number DE90607232. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The generalization of a configuration averaging to a system displaying irreversible effects is suggested. The properties of the "pathological" equilibrium state at low temperatures are determined and discussed. (author). 16 refs, 3 figs.

4215 (IC–89/121) **Strain induced amorphization of aluminium by manganese implantation.** Majid, C.A. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 31p. Order Number DE90607259. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The structural modifications of aluminium thin films implanted with manganese ions at room temperature, have been reported. These studies were performed using a two circle X-ray powder diffractometer. The method of X-ray line profile analysis was used to determine strain. As a consequence of ion bombardment, the aluminium lattice was found to undergo distortions. The maximum value of the atomic displacement U_{st} was found to be 0.14+-0.01 A, and the maximum value of the root mean square strain was noted to be 1.05+-0.15 x 10^{-3}. The lattice constant α_0 of Al was found to decrease. The decrease in α_0 was noted to be about 0.12 at %. (author). 23 refs, 10 figs.

4216 (IC–89/132) **Magnetoplasma oscillations of the wave-guided type in semiconductor superlattices.** Granada, J.C.; Kosevich, A.M.; Kosevich, Yu.A. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 16p. Order Number DE90607260. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

For electromagnetic wave-guided oscillations of two-dimensional (2D) electron layer periodic array in a transversal magnetic field, the dispersion relation is analyzed. Oscillation frequencies much lower than the electron cyclotron frequency exist under certain conditions. Additionally, the perpendicular propagation to the layers is investigated. It is demonstrated, that a strong magnetic field causes a frequency shift and splitting, which are in inverse relation to the external magnetic field and the period of the layered electron system. (author). 18 refs, 3 figs.

4217 (IC–89/156) **Statistical mechanical models for liquid and amorphous structure in covalently bonded systems.** Badirkhan, Z.; Ferrante, A.; Rovere, M.; Tosi, M.P. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 19p. Order Number DE90607233. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Considerable effort has been given for some years to developing models of interatomic forces aimed at accounting for bond directionality in liquid and amorphous state calculations. Models involving three-body potentials have been especially useful for computer simulation studies of liquid and amorphous states in elemental semiconductors and binary chalcogenides of group-IV elements, starting with the work of Stillinger and Weber on silicon. However, pair potential models that may still account for the main effects of angular dependences of the effective interatomic forces, though at a primitive level, are desirable from the viewpoint of liquid structure theory. Developments in this direction are briefly reviewed, with particular emphasis on bond particle models for the structure of liquid and amorphous germanium. We also discuss the relation between liquid structure in a bond particle model and crystallization accompanied by volume expansion, as observed in elemental and III-V polar semiconductors. (author). 34 refs, 1 tab., 3 figs.

4218 (IC–89/159) **Local coordination of polyvalent metal ions in molten halide mixtures.** Akdeniz, Z.; Tosi, M.P. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 6p. Order Number DE90607261. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Ample experimental evidence is available in the literature on the geometry and the stability of local coordination for polyvalent metal ions in molten mixtures of their halides with alkali halides. Recent schemes for classifying this evidence are discussed. Dissociation of tetrahedral halocomplexes in good ionic systems can be viewed as a classical Mott problem of bound-state stability in a conducting matrix. More generally, structural coordinates can be constructed from properties of the component elements, to separate out systems with long-lived fourfold or sixfold coordination and to distinguish between these. (author). 11 refs, 1 fig.

4219 (IC–89/197) **Electron correlations and dielectric screening in a layered electron gas.** Miesenboeck, H.M.; Tosi, M.P. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 10p. Order Number DE90607234. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A simple pseudoclassical approach is proposed to evaluate the intraplane structural correlations due to Coulomb and exchange effects between degenerate electrons in a layered electron gas model. The in-plane electron structure factor is used to estimate the local field factor accounting for exchange and correlation in the static dielectric function of the model, within the STLS and SSTL approximations. The implications of the results in relation to effective pair potentials between external charges inserted in the system are discussed with reference to ions intercalated in graphite. (author). 18 refs, 2 figs.

4220 (IC–89/239) **Interface stress theorem and Hellmann-Feynman relations for Bijellic systems.** Ziesche, P.; Nafari, N.; Kaschner, R. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 39p. Order Number DE90607235. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Starting with the general stress theorem as the dyadically generalized virial theorem for bijellic interfaces a theorem is derived relating the interface stress, i.e. the density derivatives of the interfacial energy, to an appropriate integral of the momentum flux density (local stress or stress field). This interface stress theorem together with other sum rules are tested/illustrated by calculations using the gradient expansion method. The results include the electron density, electric field, and stress field across the junction as well as the interfacial energy, interfacial stress (with its parallel and perpendicular components), the adhesive force and linear force constant for pairs of jellium densities corresponding to all alkaline interfaces. (author). 43 refs, 5 tabs, 2 figs.

4221 (INIS-BR–1702) **Study of α-monosubstituted methyl acetates by C-13 and H-1 Nuclear Magnetic resonance.** Silva, E.L. Universidade Estadual de Campinas, SP (Brazil). Inst. de Quimica. 1987. 202p. (In Portuguese). Order Number DE90607263. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The substituents effects on the methylene and carbonyl carbons chemical shifts of some α-monosubstituted methyl acetates Z-CH_2-COOMe(Z=H,Cl,Br,I,OME,SMe,NMe_2 and Me) is studied. Some data of Carbon 13 NMr in the light of the substituents empirical and electronic effects are shown. Solvent and concentration effects on the hydrogen-1 chemical shifts of methyl acetate, bromoacetate and Iodoacetate were interpreted in the light of the Cα-C(O)-bond rotational isomerism. (M.J.C.).

4222 (INIS-BR–1717) **Analysis by X-ray diffraction of new esquiatosomicides.** Zukerman-Schpector, J.; Mascarenhas, Y.P.; Katz, N. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1983. 2p. (In Portuguese). Order Number DE90607264. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. DRUGS/monocrystals; MONOCRYSTALS/x-ray diffraction; DRUGS; MONOCRYSTALS

4223 (INIS-BR–1755) **Spectroscopic analysis of orthonitrodiphenyl sulfide $C_{12}H_9NO_2S$.** Sakane, K.K. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais. 1988. 181p. (In Portuguese). Order Number

DE90607267. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

This work reports the synthesis of the first (stable) form a of orthonitrodiphenyl sulphide [1-Nitro, 2-(Phenylthio) Benzene], followed by the preparation of the metastable (β) form, obtained by the method of seeding, caracterization of this form and analysis of structural differences by means of infrared and Raman Spectra. A tentative assignment of frequencies has been made, in which some differences between the two forms are explained. This analysis was based mostly on the solid phase spectra which show striking characteristics of the polymorphic species. Spectra of the β-form are, until now, completely unpublished. The spectra of solutions and melt of the α an β forms are fairly similar to those of solid β. This feature leads to the conclusion that both forms have the same molecular structure in melt and solutions, differing only in the solid state. It is also remarkable that the β-form displays a different Infrared Spectrum in a short range interval of temperature soon after melting. In this transition phase the Spectrum is more like the solid α Spectrum. The phenomenon is credited to a transient liquid crystal character. (author).

4224 (INIS-BR–1762) **Scoria analysis by X-ray fluorescence with briquet.** Silva, G.R. da; Albert, P.E. Associacao Brasileira de Metais, Sao Paulo, SP (Brazil). 1987. 15p. (In Portuguese). (CONF-8705394–: 4. seminar of chemical control in metallurgy, Belo Horizonte (Brazil), 25-27 May 1987). Order Number DE90607268. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The sample of scoria is triturated, using boric acid as agglomerative. The briquets are analyzed by X-ray quantometry, establishing the proportions of SiO_2, P_2O_5, S, Cr_2O_3, V_2O_5, TiO_2, Al_2O_3, Mg O, Ca O, FeO and their basicity. The calibration curves are prepared with standard scoria samples, by chemical analysis. (C.G.C.).

4225 (INIS-BR–1767) **Thermoluminescent of induced calcite by gamma and ultraviolet radiation.** Lima, J.F. de. Sao Paulo Univ., SP (Brazil). Inst. de Fisica. 1987. 108p. (In Portuguese). Order Number DE90607269. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

Samples of brazilian calcite, exposed to gamma radiation in laboratory and heated at constant rate of 2.7^0 C/s, showed three glow peaks at 150, 250 and 350 ^{0}C in their thermoluminescent emission curves. The analysis of these peaks, using different models, indicated that they follow a second order kinetics; it has been obtained, for the activation energy, 1.3, 1.5 and 1.7 eV, and, for the pre-exponential factors, 8.1 x 10 ^{14}, 6.8 x10 ^{13} and 2.4 x 10^{12} s^{-1}. Although the total thermoluminescent emission has stayed constant, the relative height of glow peaks has changed with the temperature of annealing in the range of 400 to 700 ^{0}C. Exposed samples were also illuminated with ultraviolet light and the resultant curves showed partial or total bleaching or some glow peaks and the growth of peaks at lower temperatures. Samples of virgin calcite, submited to increasing exposures of gamma rays, showed a corresponding enhancement of the optical absorption bands in the range of 25000 to 47000 cm^{-1} A subsequent illumination of these samples with ultraviolet light produced a decrease of the optical absorption bands at the same range. (author).

4226 (INIS-BR–1769) **Characterization of the emerald of Santa Terezinha de Goias by spectroscopy, fluorescence and X-ray difraction.** Lariucci, C. Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica. 1988. 182p. (In Portuguese). Order Number DE90607270. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

The purpose of this work is to characterize the emerald of Santa Terezinha de Goias-GO, according to their physical properties (refractive index and specific gravity); spectrographic (infrared, ultraviolet and visible absorption); electron paramagnetic resonance; chemical analysis; crystal structure and specially by the recognition of their mineral inclusions. The results of the refractive index measure for the emerald of Santa Terezinha de Goias-GO are n_e (1.575-1.585) and n_o (1.590-1.9600) and the birrefringence = 0.012; the specific gravity is between the highest of the world (2.745 (4) Mg. m^{-3}). The near infrared and infrared absorption, show the presence, in the structural channels of the emerald, of gas carbonic and free water interacting with an ion (Fe and/or Na) in these channels. The ultraviolet and visible absorption spectra accused the presence of Cr^{3+} replacing Al^{3+} and Fe^{3+} in the channels of the structure. The study of electron paramagnetic resonance confirmed these last results.

4227 (INIS-mf–12013, pp. 38-43) **Nuclear solid state physics and technology.** Behar, M. (Rio Grande do Sul Univ., Porto Alegre (Brazil)); Bhatia, K.; Biersack, J.P.; Fink, D.; Greaves, N.; Hunklinger, S.; Kemmer, J.; Mannsperger, H.; Mueller, G.; Zinke-Allmang, M. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Nuclear instruments and methods have been applied to solid state physics and technology problems. (orig.).

4228 (INIS-mf–12013, pp. 43-46) **Nuclear spin relaxation of ^{12}B implanted in various metallic single crystals.** Sulzer, G. (Marburg Univ. (Germany, F.R.). Fachbereich 13 - Physik); Buerkmann, K.; Dippel, R.; Fischer, B.; Frank, H.P.; Ittermann, B.; Jaeger, E.; Seelinger, W.; Ackermann, H.; Stoeckmann, H.J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The studies of the diffusion of ^{12}B implanted in a single crystalline Al sample have been finished. The stopping site of ^{12}B nuclei in Cu and V have been determined by cross-relaxation measurements at room temperature. For Cu at temperatures at 480 K a new cross-relaxation spectrum showed up proving the existence of another trapping site. (orig.).

4229 (INIS-mf–12013, pp. 145) **Laboratory charging of dust by electrons and ions.** Pinter, S. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Schumacher, S.; Gruen, E.; Svestka, J. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Dust particles of sizes between 1 and 120 μm from various materials have been contained by means of an electric quadrupole field in a vacuum chamber at pressures ranging from 10^{-4} to 10^{-6} mbar. The dust particles were charged by Ar^+ ions of energies up to 3 keV as well as by electrons of energies up to 20 keV. To damp the particle motion at low pressures a damping system with two photomultipliers and feedback circuits was developed. With an improved experimental setup investigation has been started on the influence of high electric fields in the suspension system and of the rest gas density on the charging process. (orig.).

4230 (JAERI-M–89-071) **Effect of electron-excitation on radiation damage in ion-irradiated FCC metals.** Iwase, Akihiro. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 90p. (In Japanese). Order Number DE90719537. Available from NTIS (US Sales Only), PC A05/MF A01.

FCC metals (Al, Cu, Ag, Ni) were irradiated with 0.5-1.8 MeV H, He, N and Ar ions, and 84-126 MeV C, F, Si, Cl, Br and I ions at liquid helium temperatures. After the irradiations, thermal annealing experiments were performed up to 300 K. Anomalous reduction of Stage-I recovery was observed in Al and Ni irradiated with high-energy (~100 MeV) heavy ions. Radiation annealing by 100 MeV I ions was studied in predoped Ni and Cu. The experimental results were analyzed by using a new model which describes the production and radiation annealing of two or more types of defects. The extraordinarily large cross sections for subthreshold recombination of Stage-I defects were obtained in Ni. These results show that in Al and Ni, the energies transferred from the excited electrons to lattice through the electron-lattice interaction contribute to the annihilations of defects during irradiation. (author).

4231 (LA-UR–89-3334) **Strongly correlated quasi-one-dimensional bands: Ground states, optical absorption, and phonons.** Campbell, D.K.; Gammel, J.T.; Loh, E.Y. Jr. Los Alamos National Lab., NM (USA). [1989]. 20p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36.

(CONF-8907163–1: Anniversary Adriatico research conference on strongly correlated electrons, Trieste (Italy), 18-21 Jul 1989). Order Number DE90002439. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Using the Lanczos method for exact diagonalization on systems up to 14 sites, combined with a novel "phase randomization" technique for extracting more information from these small systems, we investigate several aspects of the one-dimensional Peierls-Hubbard Hamiltonian, in the context of trans-polyacetylene: the dependence of the ground state dimerization on the strength of the electron-electron interactions, including the effects of "off-diagonal" Coulomb terms generally ignored in the Hubbard model; the phonon vibrational frequencies and dispersion relations, and the optical absorption properties, including the spectrum of absorptions as a function of photon energy. These three different observables provide considerable insight into the effects of electron-electron interactions on the properties of real materials and thus into the nature of strongly correlated electron systems. 29 refs., 11 figs.

4232 (LA-UR–89-3361) **Possible FERMI liquid behavior of 5f electrons in UPt_3 at $T \gg T_K$.** Arko, A.J.; Armstrong, P.; Wire, M. Los Alamos National Lab., NM (USA). 1989. 8p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-890953–9: International conference on the physics of highly correlated electron systems, Santa Fe, NM (USA), 11-15 Sep 1989). Order Number DE90002431. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The energy of localized electrons should be independent of crystal momentum. Thus the energy of 5f electrons in heavy Fermion systems far above T_K is expected to show no E vs. k dispersion. We have used angle-resolved photoemission spectroscopy on the [1010] surface of UP_{t3}, cleaned by repeated sputter and anneal, to study any possible dispersion of the 5f bands at $T = 300\ K \gg T_K \approx 50$ K. The measurements were performed at the Synchrotron Radiation Center in Stoughton, WI, at a photon energy $h\nu = 40$ eV. At this energy the 5f cross-section is already sufficiently large to yield a significant 5f spectral weight, but not yet large enough to lose all k-dependence. Data were taken at various angle settings of a VG ADES 400 spectrometer along the Γ-M direction in the hexagonal zone. The overall instrument resolution was 250 meV while the acceptance cone of the analyzer was $\pm 2°$, or about 20% of the Γ-M direction. Although no dispersion was observed at normal emission by varying the photon energy, substantial energy dispersion, primarily in the d-bands, was evident with k_{11}. From resonant photoemission experiments we established that the primary peak associated with 5f intensity is the peak within 200 meV of E_F. Although our resolution was insufficient to observe any energy shifts, the peak disappeared at several angles near the M-point in the zone. We interpret this as dispersion above E_F. While further measurements are necessary, this raises questions regarding the accepted models for the electronic structure. 10 refs., 1 fig.

4233 (LBL–25790) **Spatially resolved localized vibrational mode spectroscopy of carbon in liquid encapsulated Czochralski grown gallium arsenide wafers.** Yau, Waifan. Lawrence Berkeley Lab., CA (USA). Apr 1988. 56p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90003121. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

Substitutional carbon on an arsenic lattice site is the shallowest and one of the most dominant acceptors in semi-insulating Liquid Encapsulated Czochralski (LEC) GaAs. However, the role of this acceptor in determining the well known "W" shape spatial variation of neutral EL2 concentration along the diameter of a LEC wafer is not known. In this thesis, we attempt to clarify the issue of the carbon acceptor's effect on this "W" shaped variation by measuring spatial profiles of this acceptor along the radius of three different as-grown LEC GaAs wafers. With localized vibrational mode absorption spectroscopy, we find that the profile of the carbon acceptor is relatively constant along the radius of each wafer. Average values of concentration are $8 \times 10E15\ cm^{-3}$, $1.1 \times 10E15\ cm^{-3}$, and $2.2 \times 10E15\ cm^{-3}$, respectively. In addition, these carbon acceptor LVM measurements indicate that a residual donor with concentration comparable to carbon exists in these wafers and it is a good candidate for the observed neutral EL2 concentration variation. 22 refs., 39 figs.

4234 (LBL–26490) **Conformation, orientation and interaction in molecular monolayers: A surface second harmonic and sum frequency generation study.** Superfine, R.; Huang, J.Y.; Shen, Y.R. Lawrence Berkeley Lab., CA (USA). Dec 1988. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890618–5: NICOLS '89: 9th international conference on laser spectroscopy, Bretton Woods, NH (USA), 18-23 Jun 1989). Order Number DE90003108. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We have used sum frequency generation (SFG) to study the order in a silane monolayer before and after the deposition of a coadsorbed liquid crystal monolayer. We observe an increase in the order of the chain of the silane molecule induced by the interpenetration of the liquid crystal molecules. By using second harmonic generation (SHG) and SFG, we have studied the orientation and conformation of the liquid crystal molecule on clean and silane coated glass surfaces. On both surfaces, the biphenyl group is tilted by 70° with the alkyl chain end pointing away from the surface. The shift in the C-H stretch frequencies in the coadsorbed system indicates a significant interaction between molecules. 9 refs., 3 figs.

4235 (LBL–27806) **Variational quantum Monte Carlo calculation of electronic and structural properties of crystals.** Louie, S.G. Lawrence Berkeley Lab., CA (USA). Sep 1989. 15p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC03-76SF00098. (CONF-8908106–5: Los Alamos workshop on quantum simulations of condensed matter phenomena, Los Alamos, NM (USA), 8-11 Aug 1989). Order Number DE90003265. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Calculation of the electronic and structural properties of solids using a variational quantum Monte Carlo nonlocal pseudopotential approach is described. Ionization potentials and electron affinities for atoms, and binding energies and structural properties for crystals are found to be in very good agreement with experiment. The approach employs a correlated many-electron wavefunction of the Jastrow-Slater form and the exact Coulomb interaction between valence electrons. One- and two-body terms in the Jastrow factor are used and found necessary for an accurate description of the electron-electron energy for the systems considered. The method has further been applied to compute various single-particle properties for solids including the single-particle orbital occupancy, electron pair correlation functions, and quasiparticle excitation energies. 23 refs., 3 figs., 3 tabs.

4236 (UCRL–100752) **First-principles interatomic potentials in transition metals: Multi-ion interactions and their analytic representation.** Moriarty, J.A. Lawrence Livermore National Lab., CA (USA). Aug 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8906238–1: Conference on many-atom interactions in solids, Pajulahti (Finland), 5-9 Jun 1989). Order Number DE90001990. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The first-principles, density-functional version of the generalized pseudopotential theory, previously developed for empty- and filled-d-band metals, has now been extended to pure transition metals with partially-filled d bands. Within this formalism, a rigorous real-space expansion of the bulk total energy has been obtained in terms of widely transferable, structure-independent interatomic potentials, including both central-force pair interactions and angular-force triplet and quadruplet interactions. In the central transition metals, the three-ion and four-ion potentials are essential to a proper description of materials properties, but are necessarily multi-dimensional functions which cannot be easily tabulated. We have, therefore, also developed a simplified version of the theory in which these potentials can be expressed analytically while retaining the most important physics of the full first-principles treatment. The analytic potentials are suitable for wide-scaled applications, including molecular-dynamics and Monte-Carlo simulation. The first-principles and analytic theories are here reviewed together with selected applications to the prediction of high-pressure structural phase transitions; phonon anomalies and their close correlation with the present multi-ion potentials; and the vacancy-formation energy. 26 refs., 4 figs., 1 tab.

4237 (UCRL–101088) **Intra-stark relaxation of Nd^{3+} in silicate glass: Subpicosecond accumulated photon echo experiments.** Lee, H.W.H. Lawrence Livermore National Lab., CA (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-890813–1: 7. international conference on dynamical processes in excited states of solids, Athens, GA (USA), 28 Aug - 2 sep 1989). Order Number DE90002786. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We have directly measured in the time domain the rates of phonon-induced population relaxation within the $^4G_{5/2}$, $^2G_{7/2}$ Stark manifold of Nd^{3+} in a silicate glass. At 13 K, these processes occur in the picosecond to subpicosecond time regime. The populations relaxation time increases with excitation frequency within each inhomogeneously broadened Stark component. Finally, the location of the Stark components within the entire inhomogeneous profile can be inferred from the data. 13 refs., 1 fig.

4238 **Optical generation of coherent surface acoustic waves: A new probe of surface dynamics and structure.** Kasinski, J.J. (Dept. of Chemistry, University of Rochester, Rochester, NY 14627 (US)); Gomez-Jahn, L.; Miller, R.J.D. *AIP Conference Proceedings (American Institute of Physics) Conference Proceedings (USA),* 172(1): 201-203 (1 Oct 1988). (CONF-871147–: 3. international laser science conference: advances in laser science, Atlantic City, NJ (USA), 1-5 Nov 1987).

The optical generation of coherent surface acoustic waves (SAW) is shown up to frequencies as high as 2 GHz on semiconductor surfaces. The frequency response of the acoustic coherence is directly related to thermal relaxation processes within the surface layer. Propagation of the optically generated SAW is shown to be sensitive to phase restructuring that occurs at solid-liquid interfaces.

4239 **Angular distribution of the photoelectron yield excited by two coherently coupled photon beams.** Berman, L.E. (National Synchrotron Light Source, Brookhaven National Laboratory, Upton, New York 11973 and School of Applied and Engineering Physics and the Cornell High Energy Synchrotron Source, Cornell University, Ithaca, New York 18453 (US)); Bedzyk, M *Physical Review Letters (USA),* 63(11): 1172-1175 (11 Sep 1989). DOE Contract AC02-76CH00016.

The angular distribution of the photoelectron yield excited by two coherently related photon beams has been calculated and measured. Dynamical Bragg diffraction from a Ge(111) single crystal was used to generate the two beams, and *L*-shell photoelectron yields from an I overlayer were measured with a variable-angular-acceptance detector. The use of two-beam photoelectric excitation to understand final-state angular momentum symmetry is demonstrated.

4240 **Cluster-impact fusion.** Beuhler, R.J. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973 (US)); Friedlander, G.; Friedman, L. *Physical Review Letters (USA),* 63(12): 1292-1295 (18 Sep 1989). DOE Contract AC02-76CH00016.

Deuteron-deuteron fusion, detected via the 3-MeV protons produced, is shown to occur when singly charged clusters of 25 to 1300 D_2O molecules, accelerated to 200 to 325 keV, impinge on TiD targets. The energy and cluster-size dependence of the fusion rate are discussed. The fusion events are shown to originate from the cluster-ion impacts rather than from D^+ or D_2O^+ ions in the beam. The observed rates may be correlated with the compressions and high energy densities created in collision spikes by cluster-ion impacts.

4241 **Comment on "Speckle in the diffraction patterns of Hendricks-Teller and icosahedral glass models".** Kan, X.B. (Department of Physics, University of Houston, Houston, Texas 77204-5504 (US)); Robertson, J.L. *Physical Review Letters (USA),* 63(13): 1438 (25 Sep 1989).

A Comment on the Letter by A. Garg and D. Levine, Phys. Rev. Lett. 60, 2160 (1988).

4242 **Temporal development of the plasma phase transition.** Bertsch, G. (Department of Physics and Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824 (US)); Brown, G.E. *Physical Review [Section] C: Nuclear Physics (USA),* 40(4): 1830-1832 (Oct 1989).

We present a simple argument to show why a high entropy phase must exhibit an extended pion source lifetime. The plasmas that would be formed under the conditions of the recent heavy ion experiments would emit pions over a time of the order of 10 fm/*c* or longer, if the plasma has an entropy density larger than that of a pion gas by an order of magnitude.

4243 **A finite temperature theory of rotationally inelastic diffraction: H_2, HD, and D_2 on Cu(100).** Cruz, A.J. (Department of Chemistry, University of Massachusetts, Amherst, Massachusetts 01003 (US)); Jackson, B. *Journal of Chemical Physics (USA),* 91(8): 4985-4993 (15 Oct 1989).

The rotationally inelastic diffraction probabilities for H_2, HD, and D_2 from Cu(100) were computed as a function of surface temperature. The surface is treated in a quantum mechanical fashion using a recently developed formalism. The center of mass molecular translational motion is treated semiclassically, using Gaussian wave packets (GWPs), and the rotations are described quantum mechanically. Strong attenuation of the phonon elastic diffraction peaks with temperature is observed. This Debye–Waller-like attenuation increases with increasing molecular mass and kinetic energy, and decreases as the peaks become more off-specular. The phonon summed rotation–diffraction probabilities show a moderate temperature dependence for the most part. The $0 \rightarrow 2$ rotational excitation of D_2 appears to be strongly phonon assisted above 300 K. At low temperatures our method reproduces the selection rules predicted by previous studies. As the temperature is increased these selection rules become less restrictive. The probability distribution for a scattering molecule exchanging an amount of energy ΔE with the surface was also computed. Rayleigh phonons were found to dominate the energy transfer, with bulk vibrations becoming more important for larger molecular masses, beam energies, and surface temperatures.

4244 **Random-tiling quasicrystal.** Strandburg, K.J. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439-4843 (US)). *Physical Review [Section] B: Condensed Matter (USA),* 39(9): 6071-6084 (15 Sep 1989). DOE Contract W-31-109-ENG-38.

The quasicrystalline phase in the two-dimensional model explored by Widom, Strandburg, and Swendsen is shown by analysis of size dependence to be very well described by a random-tiling model in which a class of configurations corresponding to tilings of the plane with rhombuses are assumed to occur with equal weight. The existence of the quasicrystalline phase in this system is thus due to entropic effects. Despite the inherent phason disorder, the system is shown to possess quasi-long-range translational order. The phason elastic constant is obtained from the simulation and is temperature independent to within our statistical errors within the quasicrystalline phase. The value is in good agreement with transfer-matrix calculations for the appropriate random tilings and with Monte Carlo simulations for random tilings. The behavior of the system for temperatures above and below the random-tiling phase is briefly discussed.

4245 **Magnetoquantum oscillations of the phonon-drag thermoelectric power in heterojunctions.** Lyo, S.K. (Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)). *Physical Review [Section] B: Condensed Matter (USA),* 39(9): 6458-6461 (15 Sep 1989). DOE Contract AC04-76DP00789.

A theory is presented for the low-temperature phonon-drag thermopower S_{xx} in a semiconductor heterojunction in a strong magnetic field. Gigantic quantum oscillations (much larger than electron-diffusion contributions) are obtained. The temperature and field dependences of S_{xx} agree well with recent data. Localized states yield flat valleys for the $|S_{xx}|$ minima in agreement with the data.

4246 **Brownian motion and finite-temperature effects in the discrete nonlinear Schroedinger equation: Analytic results for the nonadiabatic dimer.** Grigolini, P. (Department of Physics and Astronomy, University of New Mexico, Albuquerque, New Mexico 87131 (US)); Wu, H.; Kenkre, V.M. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 7045-7053 (1 Oct 1989).

The system under study is a moving quasiparticle interacting strongly with lattice vibrations. Our investigation uncovers the

effects of finite temperature through an analytical study of the quasiparticle evolution in a dimer. We display appropriate Fokker-Planck equations at several stages and, through a generalized Kramers analysis, show that localized stationary states, which are the signature of nonlinear evolution, (polaronic/solitonic behavior) are destroyed above a characteristic temperature. This result agrees with recent computer simulations in extended systems and lends analytical support to the numerical finding of the destruction of nonlinear structures above a critical temperature.

4247 First-principles molecular dynamics for metals. Fernando, G.W. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973 (US)); Qian, G.; Weinert, M.; Davenport, J.W. *Physical Review [Section] B: Condensed Matter (USA)*, 40(11): 7985-7988 (15 Oct 1989). DOE Contract AC02-76CH00016.

A Car-Parrinello-type first-principles molecular-dynamics approach capable of treating the partial occupancy of electronic states that occurs at the Fermi level in a metal is presented. The algorithms used to study metals are both simple and computationally efficient. We also discuss the connection between ordinary electronic-structure calculations and molecular-dynamics simulations as well as the role of Brillouin-zone sampling. This extension should be useful not only for metallic solids but also for solids that become metals in their liquid and/or amorphous phases.

6561 Superconductivity

Refer also to citation(s) 2904, 2905, 2910, 2914, 2931, 2947, 2949, 2950, 2951, 2954, 2956, 2957, 2958, 2959, 2961, 3011, 3118, 4204

4248 (ANL/PPRNT–89-184) **Fermi surface and effective masses for the heavy-electron superconductor UPt_3.** Norman, M.R.; Albers, R.C.; Boring, A.M.; Christensen, N.E. Argonne National Lab., IL (USA). Oct 1987. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90003001. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Local-density-approximation (LDA) calculations for the Fermi-surface extremal cross-sectional areas of UPt_3 are presented and compared to deHaas-van Alphen experiments of Taillefer et al. The topology of the calculated surfaces is in excellent agreement with experiment and allows a determination of the directional dependence of the anisotropic mass-renormalization factor. The source of this renormalization is briefly discussed. 12 refs., 4 figs., 2 tabs.

4249 (ANL/PPRNT–89-185) **The possible occurrence of multi-phase behavior in the high T_c superconductor $YBa_2Cu_3O_x$.** Beno, M.A.; Soderholm, L.; Capone, D.W. II; Hinks, D.G.; Jorgensen, J.D.; Grace, J.D.; Schuller, I.K.; Veal, B.W.; Nowicki, L.J.; Paulikas, A.P. Argonne National Lab., IL (USA). 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90002999. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We report here the results obtained for powder diffraction studies on four $YBa_2Cu_3O_x$ samples in which a model with two orthorhombic phases was used to obtain an improved agreement. The implications of this structural model on the systematic variation of T_c with oxygen content will be discussed. 28 refs., 3 figs., 2 tabs.

4250 (ANL/PPRNT–89-186) **Solubility and superconductivity in $RE(Ba_{2-x}RE_x)Cu_3O_{7+\delta}$ (RE = Nd, Sm, Eu, Gd, Dy).** Zhang, K.; Dabrowski, B.; Segre, C.U.; Hinks, D.G.; Schuller, I.K.; Jorgensen, J.D.; Slaski, M. Argonne National Lab., IL (USA). Oct 1987. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90002998. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Solid solutions of $RE(Ba_{2-x}RE_x)Cu_3O_{7-\delta}$ (RE=Nd,Sm,Eu,Gd,Dy) for x=0 to x=0.5 have been investigated. X-ray and resistivity measurements show that there exists a solid solution region, through which, the structure changes from orthorhombic to tetragonal and the superconducting properties are depressed. The solubility limits depend strongly on the size of the rare-earth ion, with the smallest (Dy) showing no appreciable solubility. The superconducting transition temperature versus x for all of the rare-earth ion substitutions falls on a universal curve, indicating that the Ba sites are extremely ionic and magnetically isolated. 20 refs., 4 figs.

4251 (ANL/PPRNT–89-197) **Linear electron-hole-electron pair model of high-temperature superconductivity in $La_{2-x}M_xCuO_4$ and $YBa_2Cu_3O_{7-y}$: 2, Dependence of the superconducting transition temperatures on pressure and on hole concentration.** Whangbo, Myung-Hwan; Evain, M.; Canadell, E.; Williams, J.M. Argonne National Lab., IL (USA). 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38;FG05-86ER45259. Order Number DE90003012. Available from NTIS, PC A03/MF A01; OSTI; INIS.

On the basis of the linear electron-hole-electron (e-h-e) pair model, we discuss how the number of holes (i.e., formal Cu^{3+} sites), and an applied pressure, affect the superconducting transition temperatures T_c of $La_{2-x}M_xCuO_4$ and $LBa_2Cu_3O_{7-y}$ (L = Y, Sm, Eu, Gd, Dy, Ho, Yb). We also examine the origin of the plateaus in the T_c vs oxygen content pilot of $YBa_2Cu_3O_{7-y}$ within the framework of the linear e-h-e pair model. 17 refs.

4252 (ANL/PPRNT–89-199) **Synthesis conductivity, and X-ray photoelectron spectrum of $Bi_2Sr_2Cu_{7+x}$. A new ternary bismuth-oxide system exhibiting metallic conductivity.** Porter, L.C.; Appleman, E.; Beno, M.A.; Cariss, C.S.; Carlson, K.D.; Cohen, H.; Geiser, U.; Thorn, R.J.; Williams, J.M. Argonne National Lab., IL (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90003010. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The preparation and some of the properties relating to the superconductive state of the newly discovered ternary bismuth oxides, $Bi_2Sr_2Cu_2O_{7+x}$, are described. Conductivity behavior ranging from semiconductive to metallic is observed when four-probe. AC resistivity measurements are carried out on pressed pellet specimens that have been annealed under different conditions. From a determination of the total oxygen present by an iodometric titration, it was found that metallic conductivity was associated with a higher oxygen content. An X-ray photoelectron experiment was carried out in order to determine whether bismuth or copper was present as the mixed-valent species. The XPS spectrum of the Bi 4f orbital electrons in the oxides was nearly identical to that observed in Bi_2O_3, with no evidence of any Bi^{5+}. 8 refs., 3 figs.

4253 (BNL–43372) **The formation of metal-oxygen species at low temperatures.** Qiu, S.L.; Lin, C.L.; Chen, Jie; Strongin, M. Brookhaven National Lab., Upton, NY (USA). 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891093–7: 36. American Vacuum Society national vacuum symposium, Boston, MA (USA), 23-27 Oct 1989). Order Number DE90002298. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The interaction of solid molecular oxygen Li, Cs, K, La, Ag, Cu, and Ba has been studied at 35 K or below using photoemission. A feature near 535 eV in the O ls core level spectra was observed when Li, Cs, K and La were deposited on solid oxygen. This feature was identified with one electron being donated to an oxygen molecule, i.e., the superoxide species, which as far as we know has not been previously reported for La and Li. A feature at about 531.5 to 533 eV was identified as a peroxide species where two electrons were donated to an oxygen molecule. Finally features at about 528 to 530.5 eV were identified as oxide phases where the molecular oxygen was dissociated into atomic oxygen with formal valence of −2. These identifications are crucial in the determinations of the exotic features in the XPS O ls spectra of the high T_c superconductors. 13 refs., 4 figs.

4254 (CONF-890939–2) **Tunneling spectroscopy and the electron-phonon interaction in $Ba_{1-x}K_xBiO_3$.** Zasadzinski, J.F.; Tralshawala, N.; Timpf, J.; Hinks, D.G.; Dabrowski, B.; Mitchell, A.W.; Richards, D.R. Argonne National Lab., IL (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on high T_c thin films and single crystals; Ustron (Poland); 30 Sep - 4 oct 1989. Order Number DE90002842. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Tunneling spectroscopy measurements have been performed on bulk samples of $Ba_{1-x}K_xBiO_3$ for the compositions, x=0.375, 0.4

and 0.5, using the natural, surface oxide as the tunnel barrier. The data show structures which are characteristic of phonon effects as seen in conventional superconductors and suggest that $\alpha^2F(\omega)$ is strongest for the high frequency optical modes. These results are consistent with other experiments and with recent microscopic calculations which indicate that phonon-mediated pairing is responsible for the superconductivity in this compound. 21 refs., 6 figs., 1 tab.

4255 (CONF-8910282–1) **Fermi surfaces by positron annihilation in $YBa_2Cu_3O_x$.** Smedskjaer, L.C. Argonne National Lab., IL (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Workshop on momentum distributions; Argonne, IL (USA); 24-26 Oct 1989. Order Number DE90002776. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We discuss how Fermi-surface signatures may obtained from 2-D ACAR positron annihilation data. We report 2-D ACAR measurements in both c- and a-axis projections on single crystal $YBa_2Cu_3O_x$ with oxygen concentration $x \approx 7$ (Tc = 93.6 K) and a set of Fermi surfaces are proposed. 5 refs., 2 figs.

4256 (LA-UR–89-3380) **Magnetic ordering in $(Y_{1-x}Pr_x)Ba_2Cu_3O_7$ as evidenced by muon spin relaxation.** Cooke, D.W.; Kwok, R.S.; Jahan, M.S.; Lichti, R.L.; Adams, T.D.; Boekema, C.; Dawson, W.D.; Kebede, A.; Schwegler, J.; Crow, J.E. Los Alamos National Lab., NM (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891117–7: 34. conference on magnetism and magnetic materials, Boston, MA (USA), 28 Nov - 1 dec 1989). Order Number DE90002393. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Using the zero-field-muon-spin-relaxation (μSR) technique we have found clear evidence for antiferromagnetic ordering of Cu moments within the CuO planes of $(Y_{1-x}Pr_x)Ba_2Cu_3O_7$. The Neel temperatures are approximately 285 K, 220 K, 35 K, 30 K, and 20 K for x = 1, 0.8, 0.6, 0.58, and 0.54, respectively. For x = 0.50 we observe a fast-relaxing component of the muon polarization in addition to a long-time tail, reminiscent of spin-glass behavior. This region of the phase diagram ($0.5 \leq x \leq 0.54$) corresponds to the existence of both superconductivity and magnetism. The fully developed local magnetic field for $x > 0.54$ is found to be ~16 mT, but decreased to ~12 mT at T = 17 K for the x = 1 sample, presumably due to the onset of Pr-ion ordering. Magnetic ordering also occurs in $PrBa_2Cu_3O_6$; the Neel temperature is ~325 K. 7 refs., 4 figs.

4257 (ORNL/FTR–3446) **[Dynamics of magnetic fluctuations in high-T_c materials]: Foreign trip report, October 5–October 15, 1989.** Mook, H.A. Jr. Oak Ridge National Lab., TN (USA). 30 Oct 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002661. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The traveler attended the NATO Workshop on Dynamics of Magnetic Fluctuations in High-Temperature Superconductors and presented an invited paper on his neutron scattering work in this field. The workshop proceedings will discuss the latest developments in various types of techniques that are sensitive to the electronic and magnetic fluctuations in high-temperature superconductors. Fields of investigation such as neutron scattering, nuclear magnetic resonance, muon spin relaxation, light scattering, and theory will be covered.

4258 (UCRL–100596-Rev.1) **Electron-positron momentum distribution measurements of high-T superconductors and related systems.** Wachs, A.L.; Turchi, P.E.A.; Howell, R.J.; Jean, Y.C.; Fluss, M.J.; West, R.N.; Kaiser, J.H.; Rayner, S.; Hahgighi, H.; Merkle, K.L.; Revcolevschi, A.; Wang, Z.Z. Lawrence Livermore National Lab., CA (USA). Aug 1989. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890718–Rev.1: International conference on materials and mechanisms of superconductivity - high-temperature superconductors, Stanford, CA (USA), 23-28 Jul 1989). Order Number DE90002974. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We discuss our measurements of the 2D-angular correlation of positron annihilation radiation (ACAR) in La_2CuO_4, $YBa_2Cu_3O_7$ (YBCO), and NiO. The measurements for NiO are the first such 2D-ACAR measurements; the YBCO results are of a higher statistical quality than previously reported in the literature. The data are compared with complementary theoretical calculations and with each other. We discuss the implication of our analysis for ACAR studies of similar and related systems. 5 refs., 1 fig.

4259 **Gap energy and long-range order in the boson-fermion model of superconductivity.** Friedberg, R. (Columbia University, New York, New York 10027 (US)); Lee, T.D. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 6745-6762 (1 Oct 1989).

From the observations of very small coherent lengths for all high-temperature superconductors, we conclude that the pair state is reasonably well localized in the coordinate space and therefore can be represented phenomenologically by a local boson field ϕ. The underlying mechanism for superconductivity is assumed to be through the "*s*-channel" reaction $2e \rightarrow \phi \rightarrow 2e$. This leads to a mixed boson-fermion model. We examine the long-range order, gap energy, and Meissner effect in such a theory.

4260 **Exchange-driven pairing of delocalized carriers in high-temperature superconductors.** Stechel, E.B. (Solid State Theory Division 1151, Sandia National Laboratories, Albuquerque, New Mexico 87185 (US)); Jennison, D.R. *Physical Review [Section] B: Condensed Matter (USA),* 40(10): 6919-6930 (1 Oct 1989). DOE Contract AC04-76DP00789.

A semiquantitative pairing model is derived from the properties of a realistic Hamiltonian for CuO_2 sheets. Due to large interactions between oxygen ions, to first-order *delocalized* carriers pair via localized spin-system holes on the Cu sublattice. The largest carrier-Cu couplings are dynamic exchange processes involving the $Cu(d^{10})$ and $Cu(d^8)$ configurations. Up to carrier concentrations of ~30–40 %, exchange-mediated attraction overcomes the large carrier Coulomb repulsion, present because of dielectric local screening. The same mechanism is shown to be capable of explaining high-temperature superconductivity in BiO_3. The pairing interaction is attractive for triplet and repulsive for singlet *s*-wave pairs.

6570 Theoretical and Mathematical Physics

Refer also to citation(s) 3077, 3078, 3820, 3877, 3929, 4044, 4049, 4168, 4309, 4310, 4314

4261 (CONF-8908179–1) **Compromise prior on the basis of maximum entropy.** River, N.; Englman, R.; Levine, R.D. Argonne National Lab., IL (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Conference on maximum entropy and bayesian methods; Hanover, NH (USA); 14-18 Aug 1989. Order Number DE90002839. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We show how to construct the best prior for a Maximum Entropy procedure when two or more priors are conceivable or are proposed. The prior is a weighted sum of the conceivable priors with weights that depend exponentially on the overlap of the prior with the exponential part of the maximum entropy probability. With additional information, one can iteratively improve the prior and sharpen the choice between alternative priors. Our construction can be used to predict in some physical cases the probability distribution functions, and to make quantitative decisions in the presence of conflicting expert opinions. 20 refs.

4262 (DOE/ER/13897–10) **The behavior of matter under nonequilibrium conditions: Fundamental aspects and applications: Progress report, April 15, 1989–April 14, 1990.** Prigogine, I. Texas Univ., Austin, TX (USA). Center for Studies in Statistical Mechanics. Oct 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13897. Order Number DE90002522. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

As in the previous period, our work has been concerned with the study of the properties of nonequilibrium systems and especially with the mechanism of self-organization. As is well-known, the study of self-organization began with the investigation of hydrodynamical or chemical instabilities studied from the point of view of macroscopic physics. The main outcome is that nonequilibrium generates spatial

correlations of macroscopic physics. The main outcome is that nonequilibrium generates spatial correlations of macroscopic range whose characteristics length is an intrinsic property and whose amplitude is determined by nonequilibrium constraints. A survey of the macroscopic approach to nonequilibrium states is given in the paper "Nonequilibrium States and Long Range Correlations in Chemical Dynamics," by G. Nicolis et al. However, over the last few years important progress has been made in the simulation of nonequilibrium situations using mainly molecular dynamics. It appears now that processes corresponding to self-organization as well as the appearance of long-range correlations can be obtained in this way starting from a program involving Newtonian dynamics (generally the laws of interaction correspond to hard spheres or hard disks). Examples of such types of studies leading to Benard instabilities, to chemical clocks, or to spatial structure formation are given in this report. As a result, we may now view self-organization as a direct expression of an appropriate microscopic dynamics. This is the reason why we have devoted much work to the study of large Poincare systems (LPS) involving continuous sets of resonances. These systems have been shown to lead, according to the constraints, either to equilibrium situations or to nonequilibrium states involving long range correlations. We discuss LPS in the frame of classical mechanics.

4263 (IC–89/80) **Construction of second constant of motion for two dimensional classical super systems.** Mishra, S.C.; Mishra, V. International Centre for Theoretical Physics, Trieste (Italy). May 1989. 13p. Order Number DE90607046. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The construction of the second constant of motion of second order (for $N \geq 2$ super-space) is carried out using Dirac's constrained Hamiltonian formalism. The invariants involving quadratic powers in velocities for a set of four representative potentials, namely (1) super harmonic oscillator, (ii) super Kepler potentials, (iii) the super potential $\lambda q^{2/3}$ and (iv) the super potential $\lambda q^2/1+gq^2$ have been derived. (author). 14 refs.

4264 (IC–89/110) **Bergman spaces, the Bloch space and the pluriharmonic conjugates in the unit ball of C^n.** Shi Jihuai. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 21p. Order Number DE90606947. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

It has been proved that if f is holomorphic in the unit ball B of C^m, then f is an element of L^p $(B,d\nu)$ if all the functions $(1 - |z|^2)^m(D^\alpha f)(z)$ with $|\alpha| = m$ are in $L^p(B,d\nu)$. This method can only deal with the case of $p \geq 1$. In this paper, we give a new approach to prove that the above result holds for all p is an element of $(0, \infty)$. A simple proof about the characterization of the Bloch space will be given. As a by-product of our approach, we generalize a theorem to the unit ball of C^m, and use this result to generalize some theorems about the pluriharmonic conjugates to the case $0 < p < 1$. 9 refs.

4265 (IC–89/111) **D^p spaces on bounded symmetric domains of C^n.** Shi Jihuai. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 11p. Order Number DE90606948. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper, the space $D^p(\Omega)$ of functions holomorphic on bounded symmetric domain of C^m is defined. We prove that $H^p(\Omega)$ is contained in $D^p(\Omega)$ if $0 < p \leq 2$ and $D^p(\Omega)$ is contained in $H^p(\Omega)$ if $p \geq 2$, and both inclusions are proper. Further we find that some theorems on $H^p(\Omega)$ can be extended to the wider class $D^p(\Omega)$ for $0 < p \leq 2$. (author). 12 refs.

4266 (IC–89/126) **New spacetime superalgebras and their Kac-Moody extension.** Bergshoeff, E.; Sezgin, E. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 13p. Order Number DE90606949. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We present new spacetime algebras whose existence is due to special Γ-matrix identities which are also necessary for the existence of super p-branes. They contain a p-th rank antisymmetric tensor, and a (p-1) rank antisymmetric tensor-spinor generator. Furthermore the translations do not commute with the supercharge. In the case of supermembranes, we find a super-Kac-Moody extension of the new spacetime algebra. We give a realization of the algebra in terms of operators in d=11 superspace, and find a connection with the d=11 supermembrane action which leads to an elegant supergeometric formulation. By double dimensional reduction, we obtain a Kac-Moody algebra for the Type IIA Green-Schwarz superstring. We also discuss the generalization of these results, including the construction of generalized super-Virasoro algebras, for super p-branes. (author). 21 refs.

4267 (IC–89/130) **Iterative methods for nonlinear set-valued operators of the monotone type with applications to operator equations.** Chidume, C.E. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 14p. Order Number DE90606950. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The fixed points of set-valued operators satisfying a condition of monotonicity type in real Banach spaces with uniformly convex dual spaces are approximated by recursive averaging processes. Applications to important classes of linear and nonlinear operator equations are also presented. (author). 33 refs.

4268 (IC–89/140) **Solvability in $D^{1,2}(\Omega)$ of the equation $-\Delta u+c=Ke^u$.** Duong Minh Duc. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 24p. Order Number DE90606951. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We establish the Sobolev inequality for a limiting case. Using this result, the Ekeland variational principle and our generalized critical values results we get the existence, nonexistence and nonuniqueness of solutions in $D^{1,2}(\Omega)$ of the equation $-\Delta u+c=Ke^u$. (author). 18 refs.

4269 (IC–89/157) **Induction on a continuous variable.** Zhang Jingzhong. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 8p. Order Number DE90606952. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Mathematical induction is a useful tool. But it could be used to prove only the proposition with form P(n) for the natural number n. Could the natural number n be replaced by a continuous variable x? Yes, and then we have the continuous induction. The continuous induction is very easy to grasp by the students who have learned mathematical induction. And it can be used to prove many basic propositions in the elementary calculus. (author).

4270 (IC–89/158) **$U_q(sl(2))$ invariant operators and minimal theories fusion matrices.** Ganchev, A.Ch.; Petkova, V.B. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 15p. Order Number DE90607043. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The existence of $U_q(sl(2))$ invariant operators for $q^p=1$ leads to relations for the quantum Clebsch-Gordan kernels and for the quantum 6j-symbols (= fusion matrices). These relations effectively reduce some equalities, inherited from the generic q case, and imply, in particular, that the polynomial identities for the quantum 6j-symbols are consistent with the minimal theories chiral fusion rules. (author). 26 refs.

4271 (IC–89/162) **Quantum sl(2) enveloping algebra and representations of braid group.** Ma Zhongqi. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 17p. Order Number DE90607044. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this note we review the relation between the Yang-Baxter equation and the braid group briefly. We discuss the quantum sl(2) enveloping algebra systematically, and present a general method to obtain a representation of the braid group from a solution of the classical Yang-Baxter equation based on a representation of a quantum simple Lie enveloping algebra. (author). 19 refs, 9 figs.

4272 (IC–89/167) **Generalized canonical quantization of dynamical systems with constraints and curved phase space.** Batalin, I.A.; Fradkin, E.S.; Fradkina, T.E. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 25p. Order Number DE90607045. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The operator version of generalized canonical quantization is formulated for dynamical systems with irreducible constraints and curved phase space. (author). 14 refs.

4273 (IC–89/171) **Self similar solutions of the second kind of nonlinear diffusion-type equations.** Diez, J.A.; Gratton, J.; Minotti, F. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 17p. Order Number DE90606953. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We study the self similar solutions of the problem of one-dimensional nonlinear diffusion of a passive scalar u (diffusivity D ~ u^m, m≥ 1) towards the centre of a cylindrical or spherical symmetry. It is shown that this problem has a self similar solution of the second kind. The self similarity exponent δ is found by solving a nonlinear eigenvalue problem arising from the requirement that the integral curve that represents the solution must join the appropriate singular points in the phase plane of the diffusion equation. In this way the integral curves that describe the solution before, and after the diffusive current arrives at the centre of symmetry can be determined. The eigenvalues for different values of the nonlinearity index m and for cylindrical and spherical geometry are computed. Numerical integration of the equations allows to determine the shape of the solution in terms of the physical variables. The application to the case m=3, corresponding (for cylindrical symmetry) to the creeping gravity currents of a very viscous liquid is worked out in detail. (author). 22 refs, 5 figs, 1 tab.

4274 (IC–89/177) **On pure radical in semigroups with zero.** Ahsan, J.; Thaheem, A.B. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 6p. Order Number DE90606954. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

We introduce pure radical of an ideal in a semigroup with zero. For this purpose we define pure, semipure and other related types of ideals, and establish some of their basic properties. 1 ref.

4275 (IC–89/183) **Note on p-semisimple BCI-algebras.** Aslam, M.; Thaheem, A.B. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 8p. Order Number DE90606955. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In this note we prove some equivalent conditions for p-semisimple BCI-algebras. We also show that if X is a p-semisimple BCI-algebra then Hom(X), the set of all homomorphisms of X is a (p-semisimple) BCI-algebra, thus extending the class of BCI-algebras with this property as proposed. We also study some duality conditions. (author). 11 refs.

4276 (IC–89/185) **N=2 supergravity in superspace and the BRS symmetry.** Kachkachi, M.; Lhallabi, T. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 16p. Order Number DE90607062. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The quantum N = 2 Einstein supergravity action is constructed by requiring the BRS symmetry. This latter is derived by the use of the distorted horizontality conditions in the curved N = 2 harmonic superspace. (author). 16 refs.

4277 (IC–89/192) **Simple application of probability model for the mean age at marriage.** Shrestha, G. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 7p. Order Number DE90606956. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

An attempt has been made in this paper to examine the age pattern of marriage among Nepalese women. A lognormal distribution has been used and applied to the data from Nepal Fertility Survey (1986). The estimation procedure has been carried out by using method of moments and maximum likelihood method. (author). 6 refs, 1 tab.

4278 (IC–89/195) **Minimal prime ideals in semigroups without nilpotent elements.** Ahsan, J. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 8p. Order Number DE90606957. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The aim of this paper is to obtain a characterization of minimal prime ideals of (non-commutative) semigroups without nilpotent elements analogous to the one for the corresponding class of rings. We also define the notion of symmetric ideals of a semigroup and establish some of their basic properties. 5 refs.

4279 (IC–89/206) **Projective cohomology over a chain complex.** Abd El-Sattar, A. Dabbour; Salama, T.M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 8p. Order Number DE90606958. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In the present work we study some topics of spectrums with morphisms and then define a cohomology construction for compact Hausdorff spaces over a chain complex as the coefficient group. It is proved that this construction is δ-functor. (author). 16 refs.

4280 (IC–89/215) **On prime ideals and associated spectrum of BCK-algebras.** Ahsan, J.; Thaheem, A.B.; Deeba, E.Y. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 12p. Order Number DE90606959. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper we study prime ideals and define the spectrum of a bounded commutative BCK-algebra. We also obtain a characterization of minimal prime (lattice) ideals of these algebras. (author). 8 refs, 4 tabs.

4281 (IC–89/216) **On the continuity of the Nemitsky operator induced by a Lipschitz continuous map.** Musina, R. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 17p. Order Number DE90606960. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Let f: R^N -> R^k be a Lipschitz continuous function and let Ω be a bounded domain in the Euclidean space R^n. For every exponent p is an element of $(1,+\infty)$, the composite map $T_f = f \circ u$ maps the Sobolev space $W^{1,p}(\Omega, R^N)$ into $W^{1,p}(\Omega, R^k)$. In the scalar case, namely, when N=1, the operator T_f is continuous from $W^{1,p}(\Omega, R^N)$ into $W^{1,p}(\Omega, R^k)$. In this paper we illustrate a counter example to the continuity of the operator T_f in case N>1. In the last part of the paper we give some sufficient conditions for the continuity of T_f, and we conclude with some examples. (author). 10 refs.

4282 (IC–89/217) **Harmonic mappings into manifolds with boundary.** Chen Yunmei; Musina, R. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 35p. Order Number DE90606961. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper we deal with harmonic maps from a compact Riemannian manifold into a manifold with boundary. In this case, a weak harmonic map is by definition a solution to a differential inclusion. In the first part of the paper we investigate the general properties of weak harmonic maps, which can be seen as solutions to a system of elliptic differential equations. In the second part we concentrate our attention on the heat flow method for harmonic maps. The result we achieve in this context extends a result by Chen and Struwe. (author). 21 refs.

4283 (INIS-mf–12013, pp. 128) **The finite temperature mean-field description and thermal fluctuations.** Davis, E.D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Miller, H.G. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. MEAN-FIELD THEORY/temperature dependence; QUANTUM MECHANICS/mean-field theory; ROTATIONAL STATES; HIGH SPIN STATES; SELF-CONSISTENT FIELD; FLUCTUATIONS; NUCLEAR STRUCTURE; NUCLEAR TEMPERATURE; PAIRING INTERACTIONS; EIGENVALUES; EIGENSTATES; ANNIHILATION OPERATORS

4284 (INIS-mf–12013, pp. 150) **Hydromagnetic space-time.** Carioli, S.M. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

This work is devoted to the study of the general properties of solutions of the coupled Einstein-Maxwell equations for a perfect magnetofluid (General Relativistic Magnetohydrodynamics, GRMHD). We point out that we are not merely considering fluid motion and electromagnetic field evolution in a given background space-time (for instance, Black Hole Electrodynamics) as astrophysicists have done so far. (orig.).

4285 (LA-UR–89-3337) **Hamiltonian chaos in a nonlinear polarized optical beam.** David, D.; Holm, D.D.; Tratnik, M.V. Los

Alamos National Lab., NM (USA). 1989. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8906239–1: Santa Fe Institute summer school on complex systems, Santa Fe, NM (USA), 5-30 Jun 1989). Order Number DE90002437. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This lecture concerns the applications of ideas about temporal complexity in Hamiltonian systems to the dynamics of an optical laser beam with arbitrary polarization propagating as a traveling wave in a medium with cubically nonlinear polarizability. We use methods from the theory of Hamiltonian systems with symmetry to study the geometry of phase space for this optical problem, transforming from C^2 to $S^3 \times S^1$, first, and then to $S^2 \times (J, \theta)$, where (J, θ) is a symplectic action-angle pair. The bifurcations of the phase portraits of the Hamiltonian motion on S_2 are classified and displayed graphically. These bifurcations take place when either J (the beam intensity), or the optical parameters of the medium are varied. After this bifurcation analysis has shown the existence of various saddle connections on S^2, the Melnikov method is used to demonstrate analytically that the traveling-wave dynamics of a polarized optical laser pulse develops chaotic behavior in the form of Smale horseshoes when propagating through spatially periodic perturbations in the optical parameters of the medium. 20 refs., 7 figs.

4286 (LA-UR–89-3465) **Symplectic numerical integration of Hamiltonian systems.** Scovel, C. Los Alamos National Lab., NM (USA). 11 Sep 1989. 38p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-8906248–1: Mathematical Sciences Research Institute workshop on geometry of Hamiltonian Systems, Berkeley, CA (USA), 6-15 Jun 1989). Order Number DE90002380. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes some general techniques available for symplectic or Lie-Poisson integration and illustrate the results with some numerical computations. In this spirit, I also discuss reversible integration, equivariant integration, integration of volume preserving flows, and symplectic cellular automata. My intention is not to be exhaustive but to give a representative review. 76 refs., 5 figs.

4287 (RRK–89-16) **(2+1)-dimensional quantum gravity.** Hosoya, Akio; Nakao, Ken-ichi. Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics. May 1989. 21p. Order Number DE90719556. Available from NTIS (US Sales Only), PC A03/MF A01.

The (2+1)-dimensional pure Einstein gravity is studied in the canonical ADM formalism, assuming that the spatial surface is closed and compact. Owing to the constraints, the dynamical variables are reduced to the moduli parameters of the 2-surface. Upon quantization, the system becomes a quantum mechanics of moduli parameters in a curved space endowed with the Weil-Petersson metric. In the case of torus in particular, the superspace, on which the wave function of universe is defined, turns out to be the fundamental region is the moduli space. The solution of the Wheeler-DeWitt equation is explicitly given as the Maass form which is perfectly regular in the superspace. (author).

4288 (SAND–89-2525C) **Detection of a chirping electromagnetic signal.** Stearns, S.D. Sandia National Labs., Albuquerque, NM (USA). [1989]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8910264–1: Asilomar conference on signals, systems and computers, Monterey, CA (USA), 31 Oct 1989). Order Number DE90002105. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A matched chirp transform (MCT) method for detecting a dispersive electromagnetic pulse is described. The unique feature of this transform is that it gives a distribution of signal amplitude over time rather than frequency, and thereby simplifies signal detection and identification in the case described here. In the MCT method, the incoming signal is matched to a set of signal segments that chirp in accordance with an expected model of the dispersive medium. The performance of the MCT method is compared with that of a standard periodogram method of frequency measurement. 6 refs., 5 figs.

4289 **An energy-minimizing mesh for the Schroedinger equation.** Levine, Z.H. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853-2501 (US)); Wilkins, J.W. *Journal of Computational Physics (USA),* 83(2): 361-372 (Aug 1989).

A formula is derived which gives the optimum placement of mesh points in the sense of minimizing the error in energy for a given number of degrees of freedom. The wave function is assumed to be given in a finite difference or finite element representation with polynomial completeness to an arbitrary but fixed degree. The result depends explicitly on the wave function, the kinetic energy operator, and the degree of polynomial completeness for the representation but does not depend explicitly on the potential, even in the presence of a Coulomb singularity. The optimum mesh predicted here for the hydrogen atom is compared to the widely used Herman–Skillman mesh. A 1-dimensional example is given in which the calculated error in energy displays a sharp minimum at the predicted optimal mesh density. The critical role of reproducing the analytic structure of the solution is illustrated with an additional example in one dimension. The hydrogen 1*s* wave function is considered as a 3-dimensional problem, and an optimal mesh density is calculated. A singular mesh density is required to account for the cusp while retaining the convergence properties of the basis set. A few percent of the available degrees of freedom are devoted to the description of the wave function cusp in the optimal mesh. © 1989 Academic Press, Inc.

4290 **Bound states of the Dirac equation outside a hard sphere.** Jaffe, R.L. (Center for Theoretical Physics, Laboratory for Nuclear Science, and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (US)); Manohar, A. *Annals of Physics (New York) (USA),* 192(2): 321-330 (Jun 1989).

We study and interpret the bound states of the Dirac equation outside a hard sphere in one, two, and three dimensions. © 1989 Academic Press, Inc.

4291 **How probability arises in quantum mechanics.** Farhi, E. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 (US)); Goldstone, J.; Gutmann, S. *Annals of Physics (New York) (USA),* 192(2): 368-382 (Jun 1989).

A version of the postulates of quantum mechanics is presented in which no reference is made to probability. Instead we rely on a weaker postulate referring to eigenvalues and eigenstates. The modulus squared of the inner product of two state vectors is shown to be an eigenvalue of the operator representing a *frequency* measurement on the system of an infinite number of copies of the original system. The argument makes essential use of the Strong Law of Large numbers. © 1989 Academic Press, Inc.

4292 **Gravitational radiation from primordial solitons and soliton-star binaries.** Gleiser, M. (Institute for Theoretical Physics, University of California, Santa Barbara, Santa Barbara, California 93106 (US)). *Physical Review Letters (USA),* 63(12): 1199-1202 (18 Sep 1989).

The possibility that both the formation of nontopological solitons in a primordial second-order phase transition and binary systems of soliton stars could generate a stochastic gravitational-wave background is examined. The present contribution in gravitational radiation to the energy density of the Universe from these processes is estimated for a number of different models. The detectability of such contributions from the timing measurements of the milisecond pulsar and spaceborne laser interferometry is briefly discussed and compared to other cosmological and local sources of background gravitational waves.

4293 **The sense in which a "weak measurement" of a spin-(1/2 particle's spin component yields a value 100.** Duck, I.M. (T. W. Bonner Nuclear Laboratory, Physics Department, Rice University, Houston, Texas 77251-1892 (US)); Stevenson, P.M.; Sudarshan, E.C.G. *Physical Review [Section] D: Particles and Fields (USA),* 40(6): 2112-2117 (15 Sep 1989).

We give a critical discussion of a recent Letter of Aharonov, Albert, and Vaidman. Although their work contains several flaws, their main point is valid: namely, that there is a sense in which a certain "weak measurement" procedure yields values outside the eigenvalue spectrum. Our analysis requires no approximations and helps

to clarify the physics behind the effect. We describe an optical analog of the experiment and discuss the conditions necessary to realize the effect experimentally.

4294 Generalized relations among *N*-dimensional Coulomb Green's functions using fractional derivatives. Blinder, S.M. (Department of Chemistry, University of Michigan, Ann Arbor, Michigan 48109 (US)); Pollock, E.L. *Journal of Mathematical Physics (New York) (USA)*, 30(10): 2285-2287 (Oct 1989).

Hostler [J. Math. Phys. **11**, 2966 (1970)] has shown that Coulomb Green's functions of different dimensionality N are related by $G^{(N+2)}=OG^{(N)}$, where O is a first-order derivative operator in the variables x and y. Thus all the even-dimensional functions are connected, as are analogously the odd-dimensional functions. It is shown that the operations of functional differentiation and integration can further connect the even- to the odd-dimensional functions, so that Hostler's relation can be extended to give $G^{(N+1)}=O^{1/2}G^{(N)}$.

4295 Generalization of Nose's isothermal molecular dynamics: Non-Hamiltonian dynamics for the canonical ensemble. Hoover, W.G. (Department of Applied Science, University of California at Davis-Livermore (US)). *Physical Review [Section] A: General Physics (USA)*, 40(5): 2814-2815 (1 Sep 1989). DOE Contract W-7405-ENG-48.

There are many potentially useful generalizations of Nose's mechanics that are both deterministic and time reversible despite the lack of an underlying Hamiltonian. These generalizations are particularly useful in simulating systems far from equilibrium.

4296 Multithermodynamic phase lattice-gas automata incorporating interparticle potentials. Chen, H. (Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)); Chen, S.; Doolen, G.D.; Lee, Y.C.; Rose, H.A. *Physical Review [Section] A: General Physics (USA)*, 40(5): 2850-2853 (1 Sep 1989).

An extension of the lattice-gas automaton model for fluid equations is presented which has nonideal-gas thermodynamic properties reminiscent of first-order phase transitions. The new idea in this model is an algorithm for including interparticle potentials.

4297 Generalization of Nose's isothermal molecular dynamics: Necessary and sufficient conditions of dynamical simulations of statistical ensembles. Jellinek, J. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439 (US)); Berry, R.S. *Physical Review [Section] A: General Physics (USA)*, 40(5): 2816-2818 (1 Sep 1989). DOE Contract W-31-109-ENG-38.

We examine the necessary and sufficient conditions that a dynamics is suited for mimicking a specified statistical ensemble. Some delicate points related to the Nose scheme and its generalizations are clarified.

4298 Characterization of an experimental strange attractor by periodic orbits. Lathrop, D.P. (Center for Nonlinear Dynamics and Department of Physics, University of Texas, Austin, Texas 78712 (US)); Kostelich, E.J. *Physical Review [Section] A: General Physics (USA)*, 40(7): 4028-4031 (1 Oct 1989).

We describe a general procedure to locate periodic saddle orbits in a chaotic attractor reconstructed from experimental data. The method is applied to data from a Belousov-Zhabotinskii chemical reaction. The eigenvalues associated with the saddle orbits are used to estimate the Lyapunov exponents. An analysis of the next amplitude map determines the allowable periodic orbits and yields an estimate of the topological entropy.

4299 Cumulant methods and short time propagators. Coalson, R.D. (Department of Chemistry, University of Pittsburgh, Pittsburgh, Pennsylvania 15260 (US)); Freeman, D.L.; Doll, J.D. *Journal of Chemical Physics (USA)*, 91(7): 4242-4248 (1 Oct 1989).

The present paper clarifies a number of issues concerning the general problem of constructing improved short time quantum mechanical propagators. Cumulant methods are shown to be a particularly convenient tool for this task. Numerical results comparing methods based on partial averaging and on gradient approaches are presented for simple model problems and for many particle quantum fluids.

70 FUSION ENERGY

7001 Plasma Research

Refer also to citation(s) 2493, 3259, 3262, 3311, 3899, 4398, 4400, 4401, 4454, 4480, 4481, 4483

4300 (CEA-CONF–9799) **Soft X-Ray amplification in laser plasmas.** Louis-Jacquet, M. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1988. 21p. (CONF-8809415–: International School of Plasma Physics, Varenna (Italy), 6-16 Sep 1988). Order Number DE90721235. Available from NTIS (US Sales Only), PC A03/MF A01.

The principles, experiments and theoretical models of soft x-ray, amplification, produced in laser plasmas, are studied. In the discussion of the principles, the laser plasma medium, the definition of the gain, the population inversions, saturation and superradiance are described. The results concerning recombination and collisional excitation experiments, as well as experimental devices are shown. A complete physical simulation to design and interpret x-ray laser experiments is given. Applications of x-ray lasers in grating production techniques, in contact microscopy and holography are considered.

4301 (CONF-891106–3) **ITER disruption modeling using TSC [Tokamak Simulation Code].** Sayer, R.O.; Peng, Y.K.M.; Wesley, J.C.; Jardin, S.C. Oak Ridge National Lab., TN (USA). 13 Nov 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 31. annual meeting of the Division of Plasma Physics of the American Physical Society; Anaheim, CA (USA); 13-17 Nov 1989. Order Number DE90002934. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Design of the ITER vacuum vessel (VV) is driven strongly by disruption-induced forces. We use the Tokamak Simulation Code (TSC) to model disruptions for the ITER physics phase (I_p = 22 MA) and predict the time evolution of currents and forces on the VV. For a plasma vertically displaced to $Z_{axis} = -1.0$m before disruption and decaying at a rate of $< dI_p/dt > \simeq -1.0$MA/ms, the induced VV current peaks at 18 MA. The maximum radial VV force F_R is 56 MN/rad; the maximum vertical force F_Z is 5.4 MN/rad; and the maximum VV disruption pressure is 1.0 MPa. Variations in VV resistance (20 - 160 $\mu\Omega$) and $< dI_p/dt >$ (1 - 2.5 MA/ms) do not change F_R significantly. The dependence of the forces on the initial plasma displacement and $< dI_p/dt >$ behavior, and the responses of other conducting structures are discussed. 2 refs., 6 figs.

4302 (CONF-8901166–1) **Ash and burn control through fishbones.** Varadarajan, V.; Miley, G.H. Illinois Univ., Urbana, IL (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER52127. From ITER burn control meeting; Livermore, CA (USA); Jan 1989. Order Number DE90001564. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The thermal alphas will accumulate in the center of the ignited thermonuclear plasma in the long pulse experiments. This accumulation increases the Z_{eff} leading to increased synchrotron losses and decreases the effective fuel density which reduces the power output. Also the ignited plasma is burn-unstable and its temperature is expected to increase above the design point until a stable equilibrium is reached at a higher temperature. This higher operating temperature is not expected to be beneficial. Thus we are faced with the dual problem of ash accumulation and thermonuclear burn instability in the steadily burning tokamak plasma. So some means of controlling them is desirable. Several control schemes for both problems have been proposed. But it is felt that we need alternatives with more desirable characteristics. In this paper, we explore the use of 'fishbones' as possible scheme that will achieve the dual purpose of ash and burn control. 3 refs.

4303 (CONF-8909257–1) **Computation of electromagnetic effects in a tokamak due to a plasma disruption.** Turner, L.R. Argonne National Lab., IL (USA). [1989]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International symposium and team workshop on 3-D electromagnetic field analysis (3DMAG); Okayama (Japan); 11-13 Sep 1989. Order Number DE90001764. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

To model the consequences of a plasma disruption in a tokamak one must combine a code that computes the detailed MHD behavior of the plasma with one that treats the three-dimensional features of the conducting toroidal components around the plasma. The NET (Next European Torus) Team have undertaken a treatment of electromagnetic effects from plasma disruptions using both open loop and closed loop integration of codes. In America, workers at Oak Ridge National Laboratory, Idaho National Engineering Laboratory, and Argonne National Laboratory have looked at plasma disruption effects on the ITER blanket using the codes TSC and EDDYNET. Results show how the forces on a blanket segment depend on the number and size of the segments and on the gap between them. 9 refs., 4 figs., 1 tab.

4304 (CONF-8910259–1-Vugraphs) **Alpha modification of Tokamak ballooning instabilities.** Spong, D.A.; Leboeuf, J-N.; Holmes, J.A.; Christenson, P.J. Oak Ridge National Lab., TN (USA). [1989]. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IAEA technical committee meeting on alpha particles/confinement and heating; Kiev (USSR); 23-26 Oct 1989. Order Number DE90001730. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper will discuss the high-n ballooning limit (drift resonant effects included in noncircular tokamak geometry) and the hybrid fluid-particle code (inhomogeneous, sheared slab geometry, full FLR alphas, linear and nonlinear).

4305 (DOE/ER/53223–118) **Uncertainties associated with extrapolating L mode energy confinement to ITER and CIT.** Riedel, K.S.; Kaye, S.M. New York Univ., NY (USA). Courant Inst. of Mathematical Sciences. Nov 1989. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53223. (MF–119). Order Number DE90002955. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We apply a two-step tokamak regression procedure to L mode confinement data. The resulting scaling expression for τ_E is similar to other published scaling expressions. Using the random coefficient model, we include tokamak to tokamak variations in our estimate of the uncertainty. We calculate an uncertainty factor of 19% and 35% in predicted confinement times for ITER and CIT respectively. The confinement uncertainties are dominated by the propagation of uncertainties arising from the tokamak to tokamak variation in scalings with q and $\bar{n}$ to the second step regression and for CIT, the lack of high magnetic field, moderate size devices in the L mode database. 11 refs., 2 figs., 4 tabs.

4306 (DOE/ER/53223–T2) **Advanced toroidal theory: Progress report.** Garabedian, P.R. New York Univ., NY (USA). [1989]. 60p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53223. Order Number DE90003376. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report briefly discusses the following topics: equilibrium and transport; including turbulent transport; stability; wave propagation; statistical data analysis; computational algorithms and computer simulations; and general plasma science.

4307 (DOE/ER/53263–7) **Fundamental studies of fusion plasmas: Annual performance report.** Aamodt, R.E.; Catto, P.J.; D'Ippolito, D.A.; Myra, J.R. Lodestar Research Corp., Boulder, CO (USA). 27 Jun 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER53263. (LRC–89-7). Order Number DE90002343. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In this paper, summary reports are given on significant new results for understanding and controlling tokamak performance under the application of high power ICH; new results on understanding the complicated interaction of plasma, atomic and surface physics in the tokamak edge plasma with intense rf fields; and new results on the neoclassical transport of energetic alpha particles.

4308 (DOE/ET/53088–370) **Stability of the Global Alfven Eigenmode in the presence of fusion alpha particles in an ignited tokamak plasma.** Fu, G.Y.; Van Dam, J.W. Texas Univ., Austin, TX (USA). Inst. for Fusion Studies. May 1989. 25p. Sponsored by U.S. DOE Energy Research; Texas Atomic Energy Research Foundation; Texas Advanced Technology Program. DOE Contract FG05-80ET53088. (IFSR–370). Order Number DE89016618. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The stability of the Global Alfven Eigenmodes is investigated in the presence of super-Alfvenic energetic particles, such as the fusion-product alpha particles in an ignited deuterium-tritium tokamak plasma. Alpha particles tend to destabilize these modes when $\omega_{*\alpha} > \omega_A$, where ω_A is the shear-Alfven modal frequency and $\omega_{*\alpha}$ is the alpha particle diamagnetic drift frequency. This destabilization due to alpha particles is found to be significantly enhanced when the alpha particles are modeled with a slowing-down distribution function rather than with a Maxwellian. However, previously neglected electron damping due to the magnetic curvature drift is found to be comparable in magnitude to the destabilizing alpha particle term. Furthermore, the effects of toroidicity are also found to be stabilizing, since the intrinsic toroidicity induces poloidal mode coupling, which enhances the parallel electron damping from the sideband shear-Alfven Landau resonance. In particular, for the parameters of the proposed Compact Ignition Tokamak, the Global Alfven Eigenmodes are found to be completely stabilized by either the electron damping that enters through the magnetic curvature drift or the damping introduced by finite toroidicity. 29 refs., 8 figs., 1 tab.

4309 (DOE/ET/53088–401) **The free energy of Maxwell-Vlasov equilibria.** Morrison, P.J.; Pfirsch, D. Texas Univ., Austin, TX (USA). Oct 1989. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–401). Order Number DE90003318. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A previously derived expression for the energy of arbitrary perturbations about arbitrary Vlasov-Maxwell equilibria is transformed into a very compact form. The new form is also obtained by a canonical transformation method for solving Vlasov's equation, which is based on Lie group theory. This method is simpler than the one used before and provides better physical insight. Finally a procedure is presented for determining the existence of negative-energy modes. In this context the question of why there is an accessibility constraint for the particles, but not for the fields, is discussed. 16 refs.

4310 (DOE/ET/53088–407) **Introduction to bifurcation theory.** Crawford, J.D.; Kueny, C.; Saphir, B.; Shadwick, B. Texas Univ., Austin, TX (USA). Inst. for Fusion Studies. Nov 1989. 73p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–407-Review). Order Number DE90003319. Available from NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.

Bifurcation theory is a subject with classical mathematical origins. The modern development of the subject starts with Poincare and the qualitative theory of differential equations. In recent years, the theory has undergone a tremendous development with the infusion of new ideas and methods from dynamical systems theory, singularity theory, group theory, and computer-assisted studies of dynamics. As a result, it is difficult to draw the boundaries of the theory with any confidence. In this review, the objects in question will be parameterized families of dynamical systems (vector fields or maps). In the sciences these families commonly arise when one formulates equations of motion to model a physical system. We specifically analyze how the time evolution near an equilibrium can change as parameters are varied; for simplicity we consider the case of a single parameter only.

4311 (FRCEA-TH–189) **Magnetic microtearing coherence in tokamak plasmas.** Mourgues, F. Aix-Marseille-2 Univ., 13 - Marseille (France). 1988. 218p. (In French). Order Number DE90721234. Available from NTIS (US Sales Only), PC A10/MF A01.

The analyses of the microtearing-modes coherence is effected. The tokamak characteristics, concerning fusion, electromagnetic confinement and turbulence are reviewed. The nature of the tearing modes, the variational principle of linear mode studies, a linear study in collisional and non-collisional plasma conditions are summarized, before studying the microtearing-mode coherence. The flux line configuration in the presence of a magnetic turbulence, the plasma response to a microtearing perturbation and instability, in the presence of a radial-electrons diffusion, is described. The autocoherence of microtearing modes in non-linear conditions are analyzed.

4312 (GA-A–19860) **Effect of energetic particle absorption on fast wave current drive.** Chiu, S.C.; Chan, V.S. General Atomics, San Diego, CA (USA). Nov 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER53277. (CONF-8910259–2: IAEA technical committee meeting on alpha particles/confinement and heating, Kiev (USSR), 23-26 Oct 1989). Order Number DE90002915. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Fast wave current drive presents a promising scheme for steady-state operation of reactor tokamaks. This scheme is being studied for application in ITER, JET, and DIII-D. There are two regimes which appear to be promising, the low frequency range $0 < \omega < 2\Omega_D$ and the lower-hybrid frequency range $\Omega_D << \omega < \omega_{LH}$. In the latter scheme, the wavelength of the fast wave becomes much shorter than the α-particle gyroradius and α-absorption can become significant. An analytic formula for α-absorption of fast waves for the standard slowing down distribution has been derived and compared with electron absorption at ITER parameters. It has been found that at $T_D > 30$ keV; and $n_e \sim 10^{14}$ cm^{-3}, the α-absorption is large and can greatly decrease the current drive efficiency. However, without sacrificing the fusion reactivity rate, by increasing the density and decreasing the temperature 15 keV $< T_D <$ 25 keV, the α-absorption can become small at a sufficiently high frequency. It is suggested that a simulation of the α-absorption effect on fast wave current drive can be made in DIII-D by using a lower frequency source (~30 MHz) to create a minority tail and a high frequency source (200 MHz) to drive current. Results of minority absorption will be presented. Effects which can improve current drive efficiency will be discussed. 11 refs., 6 figs.

4313 (IC–89/122) **Investigation of the non linear Buneman instability in a multi ion plasma.** Bulanov, S.V.; Shah, H.A.; Abdullah, T. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 18p. Order Number DE90607452. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the present work the acceleration of ions in a multi ion species plasma is investigated in the non linear state of the Buneman instability. The method used is that of transforming Eulerian coordinates to Lagrangian ones. Firstly, minority species ions are treated as test ions and for this the differential energy spectrum is obtained which is shown to be a power law. It is also shown that the heavier ions have larger energies. Secondly, self similar solutions for the case of a two ion species plasma are obtained for certain limiting cases. (author). 12 refs.

4314 (IC–89/131) **On the quantum inverse problem for a new type of nonlinear Schroedinger equation for Alfven waves in plasma.** Sen, S.; Roy Chowdhury, A. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 12p. Order Number DE90607469. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The nonlinear Alfven waves are governed by the Vector Derivative nonlinear Schroedinger (VDNLS) equation, which for parallel or quasi parallel propagation reduces to the Derivative Nonlinear Schroedinger (DNLS) equation for the circularly polarized waves. We have formulated the Quantum Inverse problem for a new type of Nonlinear Schroedinger Equation which has many properties similar to the usual NLS problem but the structure of classical and quantum R matrix are distinctly different. The commutation rules of the scattering data are obtained and the Algebraic Bethe Ansatz is formulated to derive the eigenvalue equation for the energy of the excited states. 10 refs.

4315 (IC–89/152) **Generation of axial and lateral magnetic fields in laser produced plasmas.** Bhattacharyya, B.; Pant, H.C.; Sarkar, S. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 7p. Order Number DE90607470. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The generation of both axial and lateral magnetic fields caused by the interaction of intense radiations with laser produced plasmas has been analytically studied. It is shown that the inverse bremsstrahlung absorption has an impact on the generation of the lateral magnetic field in laser produced plasmas, modifying the lateral thermal energy transport in the coronal region. However, the axial energy transport may remain unaffected. (author). 6 refs.

4316 (IC–89/172) **Ion-sound emission by Langmuir soliton reflected at density barrier.** El-Ashry, M.Y. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 11p. Order Number DE90607471. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The emission of ion-sound waves by an accelerated Langmuir soliton is studied. The acceleration of the soliton is due to an inhomogeneous density barrier. On the assumption that the kinetic energy of the Langmuir soliton is smaller than the potential energy created by the barrier. The basic equations describing the dynamic behaviour of the soliton and the emission of the ion-sound waves are formulated. The qualitative spatial distributions of the perturbed concentration in the ion-sound waves are analyzed at different characteristic points of the soliton. The energy lost by the soliton, as a result of the emission, is estimated. (author). 6 refs, 4 figs.

4317 (INIS-mf–4754(no.39)) **International bulletin on atomic and molecular data for fusion. No. 39.** Smith, J.J. (ed.). International Atomic Energy Agency, Vienna (Austria). Atomic and Molecular Data Unit. Jul 1989. 99p. Order Number DE90607372. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The Bulletin provides information on atomic and molecular data relevant for fusion research. In part I the indexed papers are listed separately for structure and spectra, atomic and molecular collisions, and surface interactions. Part II contains all the bibliographic data for both the indexed and non-indexed references (514 references). An author index is included.

4318 (IPPJ-DT–152) **Development of Fusion and Plasma Diagnostics Center - synchrotron radiation experiment, (2). Characterization of primary monochromator and construction of calibration apparatus and its application.** Sakurai, M.; Morita, S.; Yonezu, H. and others. Nagoya Univ. (Japan). Inst. of Plasma Physics. May 1989. 28p. (In Japanese). Order Number DE90719543. Available from NTIS (US Sales Only), PC A03/MF A01.

A beam line for radiometric calibration has been constructed at BL5B of UVSOR facility. The beam line was designed for the calibration of optical components, detectors, and spectrometers for plasma diagnostic devices in the VUV and soft X-ray spectral regions. It consists of a plane grating monochromator and a calibration chamber. The calibration chamber is equipped with a differential pumping system and a reflectometer. Spectral distribution, higher order contribution, and resolution of the monochromator were measured by experiments on photoemission and photo-ionization of rare gases and various solids. Some applications for the characterization of multilayer reflectors and channel electron multipliers are demonstrated. (author).

4319 (IPPJ-REV–4) **Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.** Tanaka, S.; Thomassen, K.I. (eds.). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. 102p. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Individual papers in these proceedings are indexed separately.

4320 (IPPJ-REV–4, pp. 7-10) **Particle simulation of Alfven/ion-cyclotron instabilities in a neutral-beam current-driven plasma.** Matsuda, Y. (Lawrence Livermore National Lab., CA (USA)); Tanaka, M.; Sato, T. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Low frequency, long wavelength instabilities may be excited in a tokamak plasma with current driven by a neutral beam injection. Specifically, when the beam parallel velocity is greater than the Alfven velocity of the background plasma, the Alfven waves are expected to become unstable for high enough beam density and may cause degradation of the beam current. Particle simulations were carried out to study these instabilities and their nonlinear effects on

the current. In addition, waves in the ion cyclotron frequency range are also investigated. (author).

4321 (IPPJ-REV–4, pp. 19-22) **High density current drive experiments on JFT-2M.** Uesugi, Y. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Current drive experiment by 200 MHz fast waves have been carried out to investigate a feasibility of the fast wave current drive (FWCD) in hot and dense plasmas. Four phased loop antenna array is employed to excite traveling fast waves. The wavenumber spectrum has a peak at $N_Z = 4$ with $\Delta N_Z = 4$ when Δ phi = $\pi/2$. Typical loading resistance of the antenna is about 1-1.5 Ω at n-bar$_e$ = 2 x $10^{19}m^{-3}$, and increases with the density as well as that of ICRF loop antenna. When the fast wave is applied to the ohmic plasma with T_{eo} = 1 keV and n-bar$_e$>1 x $10^{19}m^{-3}$, where the lower hybrid resonance layer locates at the plasma edge, remarkable increase of the electron temperature is observed at the plasma center. The increment of T_e depends on the antenna phasing. Effective heating is obtained at Δ phi = π where V_{ph}/V_{te} = 3-4. A noticeable loop voltage drop is observed only at Δ phi = π. When the 2nd harmonic ECH is applied to heat the plasma up to 1.5 keV, the region where the loop voltage drops is expanded into Δ phi = 2 π/3. This result indicates that the fast wave with higher phase velocity becomes to be absorbed effectively with increasing T_e. Linear theory predicts that sufficient absorption at Δ phi = $\pi/2$ requires the electron temperature of 3 keV at the plasma center and the plasma current of several tens kA will be generated by an rf power of 500 kW. (author).

4322 (IPPJ-REV–4, pp. 23-26) **Lower hybrid current drive and suppression of MHD instabilities on WT-3.** Maekawa, Takashi (Kyoto Univ. (Japan)). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Sawtooth oscillations (STO) appearing in lower hybrid current drive (LHCD) plasma (TOPIC 1) and bi-directional LHCD for production of a high βp plasma (TOPIC 2) are studied on the WT-3 tokamak. (author).

4323 (IPPJ-REV–4, pp. 27-30) **Production of high poloidal tokamak equilibria in Versator II by means of RF current drive.** Luckhardt, S.C. (Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center); Chen, K.-I.; Kesner, J.; Kirkwood, R.; Lane, B.; Porkolab, M.; Squire, J. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Experiments on the Versator II device have been carried out in a regime of low plasma current with the aim of reaching high poloidal beta, β_p. Lower-Hybrid RF current drive is used to produce an energetic electron population which carries the plasma current and pressure. In this mode of operation, plasmas with $\epsilon\beta_p$ approaching unity appear attainable. Data from equilibrium magnetic analysis, hard x-ray, and density profiles display an outward magnetic axis shift in agreement with equilibrium theory, and further indicate that q(O) is in the range of 4-6. PEST code modeling of these experiments suggests that some of these plasmas may be near or beyond the transition to the second stability region for ballooning modes. (author).

4324 (IPPJ-REV–4, pp. 31-34) **Effect of finite fast electron confinement on ECRH and LH current drive and heating.** Luckhardt, S.C. (Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

The Fisch-Boozer calculation of the efficiency of RF current drive is modified to include the effects of a finite confinement time of fast electrons, tau$_F$. The main results are: (1) The RF power absorbed, P_A is no longer equal to the power dissipated by collisions, P_D. (2) New formulas are derived for the current drive efficiency, J/P_A and the heating efficiency, P_D/P_A. These new formulas give criteria for the tau$_F$ needed to achieve best efficiency, and predict that in small tokamaks the efficiency of LHCD can be an order of magnitude larger than ECCD. This latter result provides an explanation of the low ECCD current drive efficiencies seen in small tokamaks. (author).

4325 (IPPJ-REV–4, pp. 35-38) **Coupling analysis and experiment on fast wave antenna and multijunction grill for current drive.** Ohkubo, Kunizo (Nagoya Univ. (Japan). Inst. of Plasma Physics). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. NON-INDUCTIVE CURRENT DRIVE/tokamak devices; SHORT WAVE RADIATION; ANTENNAS; COUPLING; DIPOLES; PLASMA; WAVE PACKETS

4326 (IPPJ-REV–4, pp. 39-42) **Lower hybrid current drive model and its comparison with experiments.** Yoshioka, K. (Hitachi Ltd., Ibaraki (Japan). Energy Research Lab.); Okazaki, T.; Leuterer, F. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

A simple analytical model for evaluating the lower hybrid current drive efficiency in the presence of a DC electric field is developed and its result are compared with the experimental data from the ASDEX tokamak. The model is on the basis of an analytical solution of the 'adjoint equation' to the Fokker Planck equation and considers the finite spread of the rf wave spectrum. The dependency of current drive efficiency on the DC electric field predicted by the model agrees well with that of the experiment within the experimental error. (author).

4327 (IPPJ-REV–4, pp. 43-47) **Effect of resonant-to-bulk electron momentum transfer on the efficiency of electron-cyclotron current-drive.** Matsuda, Y. (Lawrence Livermore National Lab., CA (USA)); Smith, G.R.; Cohen, R.H. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Efficiency of current drive by electron cyclotron waves is investigated numerically by a bounce-averaged Fokker-Planck code to ellucidate the effects of momentum transfer from resonant to bulk-electrons, finite bulk temperature relative to the energy of resonant electrons, and trapped electrons. Comparisons are made with existing theories to assess their validity and quantitative difference between theory and code results. Difference of nearly a factor of 2 was found in efficiency between some theory and code results. (author).

4328 (IPPJ-REV–4, pp. 48-51) **Current drive at General Atomics.** Politzer, P.A. (General Atomics, San Diego, CA (USA)).

Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. NON-INDUCTIVE CURRENT DRIVE/doublet-3 device; ELECTRON CYCLOTRON-RESONANCE; HELICITY; MAGNETIC FLUX; OSCILLATION MODES; FOKKER-PLANCK EQUATION; PLASMA; ELECTRIC CURRENTS

4329 (IPPJ-REV–4, pp. 52-55) **ECRH current drive in the presence of high energy electrons.** Taguchi, Masayoshi (Tokyo Univ. (Japan). Faculty of Engineering). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

The current-drive efficiency of the electron cyclotron resonance heating (ECRH) is investigated in tokamak plasmas with a high energy component in the electron distribution function. (author).

4330 (IPPJ-REV–4, pp. 66-69) **Electron cyclotron current drive experiments on WT-3.** Terumichi, Y. (Kyoto Univ. (Japan). Dept. of Physics). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

56 GHz, 144 kW, 100 msec EC power is injected into a target OH plasma to sustain the plasma current with 2 Ω_e EC driven current. The current up to 57 kA can be sustained without OH power during the EC pulse. The safety factor q(a) is 6.1, the electron density $n_e = 2 \times 10^{12}$ cm^{-3} and the central electron temperature Te(0) about 200 eV. The efficiency of 2 Ω_e ECCD is 0.05 (10^{19} A/Wm^2). The electron velocity distribution function is evaluated with the angular dependence of the hard x-ray energy spectrum on the direction of the toroidal magnetic field B_T. The EC power deposit profile is calculated by using the induced distribution function and the ray tracing code. (author).

4331 (IPPJ-REV–4, pp. 70-73) **Neutral beam current drive scaling in DIII-D.** Porter, G.D. (Lawrence Livermore National Lab., CA (USA)); Bhadra, D.K.; Burrell, K.H. and others. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. NEUTRAL ATOM BEAM INJECTION/doublet-3 device; NON-INDUCTIVE CURRENT DRIVE; ELECTRIC CONDUCTIVITY; SPITZER THEORY; PLASMA; HIGH-BETA PLASMA; KILO AMP BEAM CURRENTS; BOOTSTRAP MODEL

4332 (IPPJ-REV–4, pp. 74-77) **Comment on ICRF current drive in reactor grade tokamak.** Itoh, K. (Kyoto Univ., Uji (Japan). Plasma Physics Lab.); Fukuyama, A.; Itoh, S.; Kishimoto, Y.; Hamamatsu, K.; Takizuka, T. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. NON-INDUCTIVE CURRENT DRIVE/tokamak devices; ION CYCLOTRON-RESONANCE; PLASMA; FOKKER-PLANCK EQUATION; WAVE EQUATIONS; THERMONUCLEAR REACTORS

4333 (IPPJ-REV–4, pp. 78-82) **Plasma conductivity related to bootstrap current on JT-60.** Kikuchi, M. (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Azumi, M.; Tani, K. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Bootstrap current is estimated with the Hirshman-Sigmar theory and is compared with the various approximate formula. Measured resistive loop voltage is compared with the calculations using the neoclassical resistivity with and without the bootstrap current and the Spitzer resistivity for a wide range of the plasma current (I_p = 0.5-2MA) and the poloidal beta (β_P = 0.1-2.0). Recalculated resistive loop voltage is roughly consistent with the neoclassical prediction including the Bootstrap current. The inclusion of the Bootstrap current due to fast ion seems to improve the coincidence. (author).

4334 (IPPJ-REV–4, pp. 83-86) **Effect of electron spatial diffusion on current drive.** Kishimoto, Y. (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Takizuka, T.; Yamagiwa, M.; Itoh, S.; Itoh, K. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. NON-INDUCTIVE CURRENT DRIVE/electrons; SPATIAL DISTRIBUTION; ELECTRONS; PLASMA; FOKKER-PLANCK EQUATION; DIFFUSION; ELECTRIC CURRENTS; CURRENT DENSITY

4335 (IPPJ-REV–4, pp. 87-90) **Efficiency of current drive by pulsed injection of REB.** Michishita, Toshinori (Kyoto Univ. (Japan). School of Liberal Arts and Sciences). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

A simple analysis based on a relativistic Fokker-Planck equation for relativistic electron beam (REB) dynamics combined with a set of circuit equations is performed for evaluating the efficiency of current drive by a pulsed REB. A more accurate numerical result is given for the efficiency as well as for the temporal evolutions of the REB momentum distribution function and the circuit quantities. A comparison of the numerical result with the analytical limit for the efficiency is given. Optimization for the REB current drive in a reactor-grade tokamak is discussed. (author).

4336 (IPPJ-REV–4, pp. 91-94) **Bootstrap currents in toroidal systems.** Okamoto, Masao (Nagoya Univ. (Japan). Inst. of Plasma Physics). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. CLOSED PLASMA DEVICES/neoclassical transport theory; CLOSED PLASMA DEVICES/mhd equilibrium; PLASMA; PFIRSCH-SCHLUETER REGIME; ELECTRIC CURRENTS; GRAD-SHAFRANOV EQUATION; ANALYTICAL SOLUTION; BOOTSTRAP MODEL

4337 (IPPJ-REV–4, pp. 95-98) **Lower hybrid current drive activity at Princeton.** Bernabei, S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan*

fusion cooperation program exchange P148 workshop on advanced current drive concepts. Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. ASDEX TOKAMAK/lower hybrid heating; ASDEX TOKAMAK/current-drive heating; PLASMA; ELECTRIC CURRENTS; SPATIAL DISTRIBUTION; RF SYSTEMS; KLYSTRONS

4338 (IPPJ-REV–4, pp. 56-65) **Particle simulation on high power ECH current drive.** Abe, Hirotada (Kyoto Univ. (Japan)). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

The particle simulation on the ECH current drive is much tougher than the precedent simulations on the lower hybrid current drive. EM particle codes are required to simulate the ECRW propagation, the mode conversion, the associated heating, and the binary collision process at the same time in a system. The present report describes an EM code developed for these purposes. It is an advanced new code, PS2M, a particle simulation code in 2.5 dimensions (2 space-dimensions and three velocity dimensions) for electromagnetic plasmas with a pair of parallel conducting plates (a slab model). This code has some merits compared with the conventional EM codes. The spectral method is adopted for the field solver. The restriction for the grid spacing is relaxed by adopting high order spline spatial interpolation properly in accordance with the ratio of a grid spacing to a Debye length. The Courant condition is relaxed by adopting a modified partially-implicit method, which is a kind of the Crank-Nicolson scheme. Either conducting binary or absorbing boundary for the electromagnetic fields is possible. Major simulation results about the ECH current drive are also described. (N,K.).

4339 (JAERI-M–89-061) **1-dimensional single-mode nonlinear FEL amplification code. User's manual.** Kishimoto, Yasuaki; Oda, Hisako. Japan Atomic Energy Research Inst., Tokyo (Japan). May 1989. 63p. (In Japanese). Order Number DE90719544. Available from NTIS (US Sales Only), PC A04/MF A01.

The 1-dimensional single mode nonlinear FEL amplification code is developed which is useful for the basic design of Free Electron Laser. The wiggler field is given by the helical configuration, and the guide magnetic field for the stable beam propagation and the incident beam energy spread are taken into account. The tapered-wiggler with arbitrary configuration is also considered. The nonlinear FEL characteristics in the wide range from Compton to Raman regimes are analyzed since the electrostatic interaction between particles is included. The FEL code developed here is vectorized about 97%. Therefore, the large amount of parameter study for the optimization of machine design is possible. (author).

4340 (JAERI-M–89-086) **Ripple loss of alpha particles in ITER.** Tani, Keiji; Takizuka, Tomonori; Azumi, Masafumi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 29p. Order Number DE90719528. Available from NTIS (US Sales Only), PC A03/MF A01.

Part I: A benchmark test for the ripple loss of alpha particles in ITER has been executed by using an orbit-following Monte-Carlo (OFMC) code. In ITER with a plasma current of the order of 10 MA and an edge ripple of the order of 3%, the total power-loss fraction derived by JAERI's OFMC code is 6.6%. Part II: Two dimensional heat load on the first wall due to ripple loss of alpha particles in ITER has been estimated by using an OFMC code. The peak heat load due to ripple-trapped loss is of the order of 0.1 MW/m^2. The peak heat load by ripple-untrapped loss averaged over the toroidal angle is about 0.07 MW/m^2. (author).

4341 (JAERI-M–89-088) **Energy conversion efficiency in high current Raman regime free electron laser (FEL), 1. Single mode analysis.** Kishimoto, Yasuaki; Shiho, Makoto; Odajima, Kazuo; Maeda, Hikosuke; Oda, Hisako. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 30p. Order Number DE90719527. Available from NTIS (US Sales Only), PC A03/MF A01.

The effect of the longitudinal electrostatic field on the energy conversion efficiency is investigated by use of a 1-dimensional FEL amplification code. It is found that the repulsive electrostatic interaction prevents the periodic bounce motion of trapped electrons in the ponderomotive potential especially in the high current Raman operation regime. The irregular rotation of the trapped electron increases the untrapped ones, which obtained the kinetic energy from the radiation field. Resultantly, the energy conversion efficiency averaged over a long wiggler distance stays in a lower level than that predicted by the trapping argument. It is also found that the finite beam energy spread reduces the electrostatic force in the nonlinear trapping stage. The reduction of the electrostatic force recovers the periodic electron bounce motion and the associated amplitude oscillation of the radiation field. (author).

4342 (LA-UR–89-3174) **Fusion burn dynamics in dense Z-pinches (DZP).** Krakowski, R.A.; Miller, R.L.; Bathke, C.G.; Werley, K.A.; Hagenson, R.L. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–74: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002537. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The fusion burn dynamics and energy yield of the dense Z-pinch (DZP) are examined using a profile-averaged, zero-dimensional time-dependent model. A range of conditions (fuel, line density, voltage, fusion-product heating, enthalpy endless, density and temperature profiles, current rise rate, electrode impurities) are examined. Magneto-hydrodynamic stability is assumed, and initial conditions are based on those ideally existing after the melting and ionization of a solid fiber of fusion fuel. Plasma-conditions required of neutron sources for materials testing ($\dot{S}_n \geq 10^{19}$ n/s) and for possible commercial power production are examined. 25 refs., 9 figs.

4343 (PPLK-R–26) **Study on edge plasma physics and particle control in the Heliotron E device.** Mizuuchi, T. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Jul 1988. 43p. Order Number DE90719524. Available from NTIS (US Sales Only), PC A03/MF A01.

The edge plasma physics and the particle controls under the intrinsic magnetic limiter configuration of a helical system have been studied with the Heliotron E device, where currentless plasmas of $T_e \leq$ 1-2 keV, $T_i \leq$ 1 keV and n-bar$_e \leq 2 \times 10^{20}$ m^{-3} are produced by a combination of ECRH, NBI and/or ICRH. It is indicated that the separatrix region of the heliotron device is able to act as a divertor magnetic field. According to calculations of the magnetic field line in the edge region, the separatrix region has some different characteristics from the scrape-off layer in tokamak devices; the existence of a fine structure in the separatrix region and asymmetry of the region in toroidal and poloidal directions are observed. A localized pattern of the heat load on the first wall is experimentally observed. This agrees with the heat-load profile expected from the magnetic configuration and the distribution of the plasma in the edge region. A carbonization of the first wall is successfully applied to the Heliotron E device for reduction of metallic impurity contents. The heat load at the divertor trace decreases and that on the other part of the first wall increased in the high recycling conditions after the carbonization. (author).

4344 (PPLK-R–27) **Density clamping phenomena in electron cyclotron resonance heated plasmas on Heliotron E.** Zushi, H.; Noda, N.; Mizuuchi, T. and others. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Aug 1988. 46p. Order Number DE90719523. Available from NTIS (US Sales Only), PC A03/MF A01.

Particle transport and related phenomena are investigated in currentless electron cyclotron resonance heated plasmas. It is observed that during the initial phase the density stops rising and then starts to decay, in spite of continuous gas puffing. The delay time between the breakdown time and the time at which the density starts to decay depends inversely on rf power. The density profile changes drastically, becoming flat or hollow at this time. This density profile change becomes more significant as the rf power is increased. In order to sustain the density at some level the external particle source should be increased with increasing rf power. Here it is found that the particle confinement time decreases with increasing

power. The substantial increase in the particle outflux from the main plasma causes the scrape-off plasma to have a steep gradient. As a result, the amplitudes of density and magnetic fluctuations are enhanced with increasing rf power. When the cyclotron resonance layer is shifted outside the half radius, it is found that the density profile changes from hollow to centrally peaked. This result shows that the density profile is a function of the power deposition profile. It is also shown that the behavior of impurity ions (injected by the laser blow-off technique) is similar to that of the bulk particles. (author).

4345 (PPLK-R–29) **In situ measurement of neutral beam components using the Doppler-shifted H_α emissions in Heliotron E.** Kondo, Katsumi; Zushi, Hideki; Sano, Fumimichi and others. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Sep 1988. 11p. Order Number DE90719521. Available from NTIS (US Sales Only), PC A03/MF A01.

The density fraction of energy components (E,E/2,E/3,E/18) of the neutral beam was measured at the plasma center, using the Doppler-shifted H_α emissions, which were excited by electron and proton collisions in the plasma. This measurement will be useful in understanding the heating process by neutral beam injection. (author).

4346 (PPLK-R–31) **STEP code improvements and extensions.** Nakamura, Y.; Ichiguchi, K.; Wakatani, M.; Johnson, J.L. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Oct 1988. 26p. Order Number DE90719520. Available from NTIS (US Sales Only), PC A03/MF A01.

Several possible improvements and extensions of the two-dimensional stellarator expansion MHD equilibrium and stability code STEP are suggested and discussed. (author).

4347 (PPLK-R–33) **Second harmonic electron cyclotron heating in low and over density plasmas in Heliotron DR.** Morimoto, S.; Yanagi, N.; Sato, M. and others. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Dec 1988. 37p. Order Number DE90719519. Available from NTIS (US Sales Only), PC A03/MF A01.

The experiment of the second harmonic electron cyclotron heating has been carried out on Heliotron DR (R = 90cm, a-bar$_p$ $\simeq$ 7cm) by using a 28GHz, 200kW gyrotron. The plasmas are observed to be heated effectively in a wide range of electron density even above the Ordinary mode cut-off value (overdense plasma). When electron density is lower than the Extraordinary mode cut-off value, electrons are strongly heated and $T_{e\perp}$ of $\simeq$ 1.7keV has been achieved at n-bar$_e$ $\simeq$ 0.25 x 10^{13}/cm^3. The heating is found to be less sensitive to the magnetic field intensity than in larger devices such as Heliotron E and Wendelstein VII-A, and most efficient at B_0 (central magnetic field) lower than B_{res} (resonant magnetic field). These phenomena are discussed from a viewpoint of orbit of electrons accelerated in the RF field with dominant reflections at the vessel wall (cavity mode). The overdense plasmas (n-bar$_e$ > 1 x 10^{13}/cm^3), are strongly heated at B_0 higher than B_{res}. Their typical parameters are n-bar$_e$ $\simeq$ 2 x 10^{13}/cm^3, $T_{e\perp}$ $\simeq$ 330 eV and the averaged beta value, $\langle\beta\rangle$ $\simeq$ 0.4 %. The maximum $\langle\beta\rangle$ value is limited by onset of MHD instability to < or approx. 0.5 % which agrees well with a theoretical prediction for the pressure driven ideal interchange instability. A possibility of heating the overdense plasmas through mode conversion processes of injected RF waves into electron Bernstein waves is examined, and it is shown to be plausible in the present experimental condition with multiple wall reflections. (author).

4348 (PPLK-R–34) **Effect of loss cone on confinement in toroidal helical device.** Itoh, K.; Itoh, S.-I.; Fukuyama, A.; Hanatani, K. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Dec 1988. 42p. Order Number DE90719518. Available from NTIS (US Sales Only), PC A03/MF A01.

Analytical estimation is given on the loss cone in the toroidal helical devices in the presence of the radial electric field and the modulation of the helical ripple. The minimum energy of particles entering the loss cone is calculated. The modulation is not always effective in reducing the loss in the presence of the radial electric field. The plasma loss due to the loss cone is estimated in the collisionless limit. The radial electric field is estimated in the presence of the loss cone. It is found that the transition to the solution with positive radial electric field, which is necessary to achieve the high-ion-temperature mode, becomes difficult. This difficulty is large for the systems with the small helical ripple. (author).

4349 (PPLK-R–35) **Investigation of boundary for the negative ion extraction in the sheet-plasma negative ion source.** Jimbo, Kouichi; Uramoto, Joshin. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Sep 1988. 24p. Order Number DE90719532. Available from NTIS (US Sales Only), PC A03/MF A01.

The negative ion current obtained in the sheet-plasma negative ion source increases when the stainless chamber is biased negative under the same plasma condition. At the same time the electron saturation current of the probe measurement also increases. In the classical treatment of sheath, the plasma-sheath equation was solved in the high order charge neutrality in plasmas, and the concept of presheath was introduced to satisfy the Bohm sheath criterion. The plasma space potential was calculated from the equality of ion and electron fluxes. However, the ion-acoustic instability is excited in that case. We show that the plasma-sheath equation has another solution and the plasma space potential is obtained self-consistently. The effect of negative currents are discussed at the same time. We conclude that the plasma space potential relative to the ground level is the crucial parameter to extract negative ions efficiently from plasmas. (author).

4350 (PPPL–2651) **Energy confinement time and electron density profile shape in TFTR [Tokamak Fusion Test Reactor].** Park, H.K.; Bell, M.G.; Goldston, R.J.; Hawryluk, R.J.; Johnson, D.W.; Scott, S.D.; Wieland, R.M.; Zarnstorff, M.C.; Bitter, M.; Bretz, N.; Budny, R.; Dylla, H.F.; Grek, B.; Howell, R.B.; Hsuan , H.; Johnson, L.C.; Mansfield, D.K.; Ramsey, A.T.; Schivell, Princeton Univ., NJ (USA). Plasma Physics Lab. Nov 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90001819. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The electron density profiles of intense deuterium neutral-beam-heated plasmas (P_{tot}/P_{ohm} > 10) are characterized as a peakedness parameter (F_{ne} = $n_{eo}/\langle n_e\rangle$) in the Tokamak Fusion Test Reactor (TFTR). The gross energy confinement time (τ_E = E_{tot}/P_{tot}) at the time of maximum stored energy is found to be a weak function of the plasma current and total heating power but depends strongly on the peakedness parameter. A regression study showed τ_E = 2.4 x $10^{-3} F_{ne}^{0.76} I_p^{0.18} P_{tot}^{-0.12}$ for a data set of 561 discharges in the TFTR. Also τ_E can be represented as τ_E = $\tau_E^L f(F_{ne})$, where τ_E^L is the empirical L-mode scaling result. A similar scaling applies to an appropriately defined incremental energy confinement time (τ_{inc} = $dE_{tot}/dP_{tot}|_{F_{ne}=constant}$). 14 refs., 4 figs.

4351 (PPPL–2660) **Study of electron density and pressure profile behavior in a tokamak plasma.** Park, H.K.; Goldston, R.J.; Taylor, G. Princeton Univ., NJ (USA). Plasma Physics Lab. Nov 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90003295. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Simultaneous determinations of local electron density and magnetic flux surface in a tokamak plasma have been made feasible with multichannel interferometry using a new asymmetric Abel inversion method. This new method takes advantage of interferometry by measuring the electron density profile as a function of time. The derived electron density parameters, such as the total number of electrons, peak density, and the profile shape factor, have been extremely useful in tokamak plasma experiments. In addition, by suing measured time-dependent electron temperatures from electron cyclotron emission, similar parameters for the electron pressure can be studied. 16 refs., 3 figs.

4352 (UCID–21744) **MTX [Microwave Tokamak Experiment] diagnostic and auxiliary systems for confinement, transport, and plasma physics studies.** Hooper, E.B.; Allen, S.L.; Casper, T.A.; Thomassen, K.I. Lawrence Livermore National Lab., CA (USA). 28 Jul 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE90002636. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This note describes the diagnostics and auxiliary systems on the Microwave Tokamak Experiment (MTX) for confinement, transport, and other plasma physics studies. It is intended as a reference on

the installed and planned hardware on the machine for those who need more familiarity with this equipment. Combined with the tokamak itself, these systems define the opportunities and capabilities for experiments in the MTX facility. We also illustrate how these instruments and equipment are to be used in carrying out the MTX Operations Plan. Near term goals for MTX are focussed on the absorption and heating by the microwave beam from the FEL, but the Plan also includes using the facility to study fundamental phenomena in the plasma, to control MHD activity, and to drive current noninductively.

4353 (UCRL–21248) **The coupling of stimulated Raman and Brillouin scattering in a plasma.** Umstadter, D.; Mori, W.B.; Joshi, C. Lawrence Livermore National Lab., CA (USA). 19 Sep 1988. 17p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AS03-83ER40120;W-7405-ENG-48. ECS-83-10972. Order Number DE90002825. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The observation of an anti-Stokes satellite in the spectrum of light backscattered from a CO_2 laser plasma is reported. Its origin is found to be Thomson scattering of the incident light from a counterpropagating mode-coupled plasma wave. The parent electron and ion waves in the mode-coupling process were driven by stimulated Raman and Brillouin backscattering. The parent and daughter plasma waves were detected by ruby laser Thomson scattering. A computer simulation modeling the experiment shows further cascading of the Stokes backscattered light to lower frequencies, apparently due to its rescattering by another, higher phase velocity, counterpropagating coupled mode. Comparisons with theoretical predictions are presented. 16 refs., 4 figs.

4354 (UCRL–21250) **Computer simulation of laser plasma interaction: Progress report for 1988.** Dawson, J.M. Lawrence Livermore National Lab., CA (USA). 1988. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90002828. Available from OSTI; GPO Dep.

During the past year, we have also been investigating some new ideas on laser plasma interactions. In particular we have been investigating the possibility of using plasmas to upshift the frequency of laser light in a tunable fashion. Two techniques are discussed in this paper.

4355 (UCRL–52000-89-10) **Energy and Technology Review, October 1989.** Burnham, A.K.; de Vore, L.; Gleason, K.; Kirvel, R.D.; Sanford, N.M.; Taft, S.O. (eds.). Lawrence Livermore National Lab., CA (USA). Oct 1989. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90002620. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This Energy and Technology Review contains reports on: A simple, Efficient Interprocess Communication System for Dissimilar Networked Computers; Low-Density Polymer Foams for Fusion-Fuel Capsules; and The Compact Torus as the basis for a new type of accelerator, which has potential applications in fusion energy generation and other fields.

4356 (UCRL–97265) **2.5D EM direct implicit PIC simulation using AVANTI.** Hewett, D.W.; Langdon, A.B. Lawrence Livermore National Lab., CA (USA). 18 Aug 1987. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-870947–12: 12. conference on the numerical simulation of plasmas, San Francisco, CA (USA), 20-23 Sep 1987). Order Number DE90002886. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An appealing feature of the well-known PIC algorithm for plasma simulations is the intuitive connection of the plasma representation with real plasmas. Working directly with macro "particles" provides intuition about plasma behavior but at greater computational expense for the extra detail that the method provides. Further, traditional explicit fully electromagnetic PIC algorithms still have stability and accuracy constraints that demand microscopic details be resolved in time and space. Recent progress in making the PIC algorithm implicit have been successful in allowing selective resolution in space and time of only those plasma phenomena of interest. We present here an overview of one of these procedures known as the direct implicit method as implemented in the LLNL code AVANTI. 6 refs.

4357 (UCRL–97266) **Relativistic extension of the electromagnetic direct implicit PIC algorithm.** Langdon, A.B.; Hewett, D.W. Lawrence Livermore National Lab., CA (USA). 18 Aug 1987. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-870947–13: 12. conference on the numerical simulation of plasmas, San Francisco, CA (USA), 20-23 Sep 1987). Order Number DE90002888. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The PIC model provides a very complete representation of plasma behavior that is essential when investigating phenomena requiring velocity space information such as laser-plasma interactions. New implicit PIC algorithms have expanded considerably in both space and time the scope of problems that may be addressed with this model. Applications of the new code AVANTI, based on our version of the Direct Implicit PIC algorithm, frequently require a relativistic representation of the plasma. We present here a relativistic extension of the plasma representation of this method. 6 refs.

4358 (UCRL–101105) **The MTX [Microwave Tokamak Experiment] data acquisition system.** Butner, D.N.; Drlik, M.; Brown, M.D.; Casper, T.A.; Meyer, W.H.; Moller, J.M. Lawrence Livermore National Lab., CA (USA). 20 Sep 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-891007–87: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002982. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The diagnostic data from the MTX experiment is acquired and processed by an expandable, distributed, multivendor computer network. The system blends a variety of software into a coordinated, unified, and highly flexible design. Using modular software design techniques, we created a system stressing distributed processing, portability, and transparent data access. In our approach to modularity, we standardized communication interfaces between modules and separated generic tasks from machine and application-specific implementations. For flexible distributed processing, we used modular, portable software and LLNL facility that provides an interprocess communication system (IPCS) in the multivendor network. With transparent data access, any program can access data stored anywhere in the network without knowing the specific location. The computer hardware includes a DEC VAX cluster, HP workstations and HP desktop computers. We are using commercial software in addition to packages from MIT, ORNL, and LLNL. 4 refs., 4 figs.

4359 **The theory of target compression by longwave laser emission.** Proceedings of the Lebedev Physics Institute. Academy of Sciences of the USSR. Volume 170. Sklizkov, G.V. 167p. Nova Science Publishers, Inc., Commack, NY (1987).

This book covers the proceedings of the Lebedev Physics Insititute Academy of Sciences of the USSR. The papers include: Energy transfer by fast electrons in spherical laser targets; Simple models of fast electron generation in laser plasma; and Numerical modeling of fast electron energy transfer.

4360 **Status of the design and construction of the CPRF and the ZTH reversed field pinch experiment.** Thullen, P. (Los Alamos National Lab., Los Alamos, NM (US)); Schoenberg, K.F.; DiMarco, J.N. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2A3.

The Confinement Physics Research Facility (CPRF) and the first experimental device to be tested in it, the ZTH reversed field pinch, are being designed and constructed by the Los Alamos National Laboratory. The CPRF and ZTH will be completed in the last quarter of 1992, with a capability for operation of ZTH at 2 MA plasma current. The CPRF is designed to allow operation of ZTH at 4 MA plasma current following alteration of the ZTH structure and torus, and installation of additional power supplies. This paper presents an overview of the physics goals of the ZTH experiment and the state of the CPRF/ZTH Construction Program.

4361 Electron plasma interactions in crossed fields. Kaup, D.J. (Clarkson Univ. (US)); Pitale, L.A. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 1C6.

In this paper the interactions of a non-neutral electron plasma in the presence of non-uniform cross fields within a slow wave structure is investigated. A variational approach is applied to calculate modifications to both RF wave and plasma parameters. The RF wave is modeled with a modal solution of the boundary value problem, while a cold-fluid approximation is taken for the plasma. The specific case is non-relativistic ans assumes propagation of a single. The results of the analysis show frequency shifts obtained by taking appropriate variations of plasma parameters.

4362 Fields and flows in diffusing ionospheric plasmas. Kadish, A. (Atmospheric Sciences Group, Earth and Space Sciences Div., Los Alamos National Lab., Los Alamos, NM (US)). pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 1A6.

This paper describes the long-time behavior of ionospheric plasmas determined, in part, by self-magnetic fields that induce charged particle drifts and contribute to the Lorentz force on bulk ion and electron flows. Although short-time effects are small if the plasma-beta is low, the cumulative effects of the self-field cannot be ignored when predicting long-time behavior and location of plasma releases.

4363 Phase conjugate reflection of electromagnetic waves from a plasma. Tzach, D. (Univ. of California, Irvine, CA (US)); Fisher, A.; Rostoker, N.; Benford, G.; Garate, E.; Nebenzahl, I.; Ron, A. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 1C7.

In this paper the authors discuss the possibility of using a plasma, as the nonlinear medium, for generating phase conjugate reflection of electromagnetic waves in the microwave region, by almost degenerate four wave mixing. The reflected beam can be significantly amplified by the plasma. They show that the phase conjugate reflection is of significant magnitude if the frequency and the wave vector difference of the signal wave, with respect to the pump waves, resonate with the frequency and the wave vector of the ion acoustic mode of the plasma. The main results of the theory developed are described. Possible applications of the emergent technology are discussed, as well as results of preliminary experiment.

4364 Characteristics of plasma produced by an RF induction discharge. Cho, M.H. (Univ. of Wisconsin-Madison (US)); Kim, G.H.; Hershkowitz, N.; Nonn, P.; DeKock, J. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2P18.

The authors have performed experimental studies on an electrodeless rf induction plasma generator using a multidipole device. This source uses a single turn loop antenna made out of an enamel coated copper strip, and operates at frequencies ranging from ~1MHz to ~20MHz depending on the tuned resonance frequency, and at the neutral gas pressure $\geq 5 \times 10^{-5}$ torr. It has been operated with several different type of gases and their mixtures (Ar, N_2, H_2, and CH_4). The detailed description of the plasma source is presented together with the characteristics of plasmas.

4365 Study of a plasma edge cathode scheme for electron beam extraction. Grothaus, M.G. (Dept. of Electrical Engineering, Texas Tech Univ., Lubbock, TX (US)); Cunningham, J.; Zieher, K.W. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2P27.

High power cold electron cathodes are limited in their applications to extraction pulses shorter than about 1 microsecond. The plasma generated on the cold field enhanced emitter expands into the extraction gap with a velocity of several cm/microsecond. This leads to closure and shorting of the extraction gap for larger times. The closure of the extraction gap should be avoidable if one extracts electrons transversely off the flow of a plasma jet. In an experiment, the plasma jet is intercepted partially by an obstacle. This paper describes the flow of the plasma and the development of the transverse boundary of the plasma behind the obstacle investigated experimentally and simulated on a computer.

4366 Effect of electron prebunching on the radiation growth rate in a collective (Raman) free electron laser amplifier. Leibovitch, C. (Rafael Lab., Haifa 310201 (IL)); Xu, K.; Bekefi, G. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2P35.

In this paper experiments are reported on the effects of electron prebunching in a mildly relativistic free electron laser amplifier operating in the collective (Raman) regime. Prebunching is established by injecting a monochromatic wave into a bifilar helical wiggler interaction region. The growth rates are deduced from observations of the radiation intensity as a function of interaction length. Results are presented both in the small signal (linear) and saturated (nonlinear) regimes.

4367 Extension of lower hybrid drift instability into the neutral sheet of the earth's magnetotail. Lui, A.T.Y. (Applied Physics Lab., Johns Hopkins Univ., Laurel, MD (US)); Mankofsky, A.; Papadopoulos, K.; Drobot, A. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 1A5.

Spacecraft measurements indicate the presence of broadband electrostatic turbulence in the earth's magnetotail, mostly in the region of the plasma sheet boundary layer, and occasionally in the neutral sheet region. The lower hybrid drift (LHD) instability has been investigated theoretically to account for the observed microturbulence. In this paper, the authors propose a mechanism for overcoming the electron resonance broadening stabilization by the presence of an electric field. The required electric field strength based on this idea is estimated and is found to be in agreement with space observations at times when the turbulence is present in the neutral sheet region.

4368 Reflection of accelerated plasma rings from conical electrodes in the RACE experiment. Hartman, C.W. (Lawrence Livermore National Lab. (US)); Hammer, J.H.; Eddleman, J.L.; McLean, H.S. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 3A5.

This paper describes the plasma ring acceleration Experiment, RACE, in which plasma rings confined magnetically in a compact torus are accelerated in a 4-meter long, straight coaxial rail-gun configuration. Rings, having initial magnetic energy $U_m \simeq 2$ kj, are accelerated to kinetic energies of $U_k \simeq 10$ - 20 kJ and injected into a 2-meter long coaxial cone section at the end of the accelerator. Magnetic field probes arrayed along the straight section and cone at the outer electrode show penetration of the ring into the cone, reflection, and in may shots, stagnation and slow decay (tau $\simeq$ 100 - 200μ s) of the reflected ring near the entrance of the cone.

4369 X and UV time resolving diagnostics for X-ray laser experiments. Naccach, D. (Centre d'Etudes de Limeil-Valenton (FR)); Bourgade, J.L.; Combis, P.; Louis-Jacquet, M.; Keane, C.; MacGowan, B.; Matthews, D. pp. 160 of Conference record of the

1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2P56.

The authors describe their instruments which combine either transmission or reflection gratings in combination with x-ray streak cameras or microchannel plate intensifiers, respectively. They also review their diagnostics which use conventional x-ray diffraction crystals with x-ray streak cameras as detectors. They emphasize our measurements which embody high sensitivity, wavelength discrimination and time resolution in order to detect short time phenomena. These diagnostics provide us with measurements of x-ray lasing output and plasma ionization kinetics for long cylindrical plasmas under the conditions necessary to produce an x-ray amplifier. Typical data from many different targets are shown.

4370 **Broadband phase conversion of the frequency tripled Omega laser.** Kessler, T.J. (Rochester Univ., NY (USA). Lab. for Laser Energetics); Letzring, S.; Skupsky, S.; Skeldon, M.; Morse, S.; Jaanimagi, P. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper WD5.

One year ago, implementation of distributed phase plates on the twenty-four frequency tripled beamlines of the Omega laser system had increased the overall irradiation uniformity to an ~10% (rms) level. Target performance increased as a result of reducing the irradiation hot spots due to normal beam focusing. However, target performance did not improve to the level of theoretical predictions. At the Laboratory for Laser Energetics, the authors spent the last year reviewing the various aspects of irradiation uniformity. Issues such as beam pointing and focusing, beam to beam timing, and energy balance and spatial uniformity are analyzed in this paper.

4371 **Structure of slow magnetosonic shocks in low beta plasmas.** Omidi, N. (Department of Electrical and Computer Engineering, University of California at San Diego (US)); Winske, D. *Geophysical Research Letters (USA)*, 16(8): 907-910 (Aug 1989).

Slow magnetosonic shocks are an efficient way in which magnetic energy in a collisionless plasma is converted into particle flow and thermal energy. Previous analytic and simulation studies of slow shocks have suggested that their structure consists of a damped wavetrain beginning at the shock transition and extending into the downstream region. Spacecraft observations in the solar wind and the Earth's magnetotail have found structures that resemble slow shocks except that most of them do not possess a trailing wavetrain. To resolve the conflict between theory and observations of slow shocks, we have performed new simulations which correct some of the previous results and show that depending on the sonic Mach number and the ratio of electron to ion temperature, slow shocks may or may not possess a wavetrain. © American Geophysical Union 1989

4372 **Second stability in the ATF torsatron.** Harris, J.H. (Oak Ridge National Laboratory, Oak Ridge, TN (US)); Murakami, M.; Carreras, B.A.; Bell, J.D.; Bell, G.L.; Bigelow, T.S.; Charlton, L.A.; Dominguez, N.; Dunlap, J.L.; Glowienka, J.C.; and others. *Physical Review Letters (USA)*, 63(12): 1249-1252 (18 Sep 1989).

Access to the MHD second stability regime has been achieved in the ATF torsatron. Experimental β values $\beta_0 \lesssim 3\%$, with fast ions contributing $\approx$(1/3 of the pressure at high β) are well above the theoretical transition value ($\beta_c \approx 1.3\%$ for ideal modes) required to reach this regime. The relatively low β_c results from operation with peaked pressure profiles. The measured magnetic fluctuations decrease with increasing β, and the pressure profile broadens. This behavior is consistent with theoretical predictions for β self-stabilization of resistive interchange modes.

4373 **Cyclotron emission asymmetry from Kirchhoff's law in a mode-conversion layer.** Swanson, D.G. (Department of Physics, Auburn University, Auburn, Alabama 36849 (US)); Cho, S. *Physical Review Letters (USA)*, 63(13): 1386-1389 (25 Sep 1989).

Cyclotron radiation of both fast (Alfven waves) and slow (Bernstein) waves from a mode-conversion layer is considered to find relations between cyclotron absorption and emission in an inhomogeneous plasma. The relative emission ratios among various modes are calculated and asymmetries of emission are discussed. From relations between emission and absorption, a form of Kirchhoff's law for a mode-conversion layer is proved from general thermodynamic arguments and from the mode-conversion tunneling equation.

4374 **Excitation of the toroidicity-induced shear Alfven eigenmode by fusion alpha particles in an ignited tokamak.** Fu, G.Y. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712 (US)); Van Dam, J.W. *Physics of Fluids B: Plasma Physics (USA)*, 1(10): 1949-1952 (Oct 1989).

The toroidicity-induced shear Alfven eigenmode is found to be destabilized by fusion alpha particles in an ignited tokamak plasma.

4375 **Theory of weak ion temperature gradient-driven turbulence near the threshold of instability.** Mattor, N. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712 (US)); Diamond, P.H. *Physics of Fluids B: Plasma Physics (USA)*, 1(10): 1980-1992 (Oct 1989).

In this paper a theory of weak ion temperature gradient-driven turbulence near the threshold of instability is presented. The model considers kinetic ions and adiabatic electrons in a sheared slab geometry. Linear theory shows that for $\eta_{th} < \eta_i \lesssim \eta_{th}+(1+T_i/T_e)\ L_n/L_s$ (where $\eta_{th}=0.95$ is the instability threshold and $L_n/L_s \ll 1$) then $\gamma \ll \omega$ and a weak turbulence theory applies. The nonlinear wave kinetic equation indicates that ion Compton scattering is the dominant nonlinear saturation process, and it is shown that the energy scatters to the linearly stable low k_y modes. The resulting fluctuation spectrum (peaked about $k_\perp \rho_i \cong 1$) is much lower than that suggested by naive extrapolation from the strong turbulence regime. The resulting ion thermal conductivity is also extremely low, so that strong ion heating can be expected to drive the ion temperature gradient to a level where this weakly turbulent threshold regime is surpassed. Thus the critical η_i relevant to magnetic confinement experiments is not the linear instability threshold but the point where the diminutions of the weak turbulence regime vanish, and the transport increases to the strong fluid turbulence level.

4376 **Ion temperature gradient-driven turbulence in tokamaks with flat density profiles.** Mattor, N. (Institute for Fusion Studies, The University of Texas at Austin, Austin, Texas 78712 (US)); Diamond, P.H. *Physics of Fluids B: Plasma Physics (USA)*, 1(10): 1993-1997 (Oct 1989).

The theory of ion temperature gradient-driven turbulence in tokamaks is extended to the flat density regime. The values of ion and electron thermal conductivities, χ_i and χ_e, momentum diffusivity χ_φ, and particle flux Γ_r are also calculated. These formulas extend previous calculations, which were restricted to the regime $L_n < (L_s L_T)^{1/2}$ [Phys. Fluids **29**, 3291 (1986); Phys. Fluids **31**, 1180 (1988)]. This allows an assessment of the role of ion temperature gradient turbulence in H modes, where the density gradient is often observed to be flattened in the plasma core.

4377 **Parametric instabilities of Langmuir waves in weak/moderate magnetic fields.** Akimoto, K. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545 (US)). *Physics of Fluids B: Plasma Physics (USA)*, 1(10): 1998-2009 (Oct 1989).

A general dispersion equation, which describes the parametric instabilities of some electrostatic waves in a weak/moderate magnetic field, is derived. The dispersion equation is solved numerically to study the effects of a moderately intense magnetic field on the parametric instabilities of relatively large amplitude Langmuir waves. A Langmuir pump wave can couple with various low-frequency branches such as lower-hybrid, electron-acoustic, ion-cyclotron, and ion-acoustic branches. The transverse modulational instability is most sensitive to a magnetic field. Even for a Langmuir wave with $\tilde{W} \sim 0.1$, where $\tilde{W}$ is the ratio of the time-averaged wave energy to the electron thermal energy, some portions of the transverse modulational instability in the direction exactly perpendicular to the external magnetic field are quite easily suppressed. However, some oblique instabilities may be enhanced by a magnetic field. In general, a moderate magnetic field suppresses most of the oblique instabilities, and the parametric instabilities become essentially one dimensional.

4378 Preferential electron-cyclotron heating of hot electrons and formation of overdense plasmas. Quon, B.H. (Applied Microwave Plasma Concepts, Inc., Carlsbad, California 92009 (US)); Dandl, R.A. *Physics of Fluids B: Plasma Physics (USA),* 1(10): 2010-2017 (Oct 1989).

Three electron-cyclotron-heating techniques, which preferentially couple microwave power to different energy segments of the electron distribution function, have been experimentally investigated in the AMPHED facility [C. Bodeldijk, Special Supplement, Nucl. Fusion **26**, 184 (1986)]. Whistler waves launched from the high-field mirror throat are strongly absorbed in a single pass across the resonant interaction layer, producing highly overdense cold background plasma but no relativistic hot particles. On the other hand, ordinary waves launched from the system side wall are only weakly damped, giving rise to local cylindrical cavity modes and preferential coupling to hot electrons in the 100 keV region. Low levels ($\lesssim$5%) of upper-off-resonance heating power were shown to be most effective for preferential hot-electron plasma formation, with ~100% of the injected power being absorbed by the energetic electrons.

4379 Temperature fluctuations and transport in a tokamak edge plasma. Lin, H. (Fusion Research Center, University of Texas, Austin, Texas 78712-1068 (US)); Bengtson, R.D.; Ritz, C.P. *Physics of Fluids B: Plasma Physics (USA),* 1(10): 2027-2030 (Oct 1989).

Using the technique first described by Robinson and Rusbridge [Plasma Phys. **11**, 73 (1969)] electron temperature fluctuations have been measured in the scrape-off layer of the TEXT tokamak [Nucl. Technol. Fusion **1**, 479 (1981)] to be $\tilde{T}_e/T_e \geq 0.4\tilde{n}_e/n_e$. Particle and energy transport were estimated from $\langle \tilde{n}_e \tilde{E}_\theta \rangle$ and $\langle \tilde{T}_e \tilde{E}_\theta \rangle$ correlations. The fluctuation-driven particle transport was consistent with earlier measurements and with measurements of global particle confinement. A high correlation of temperature and electric field fluctuations and a low but positive correlation between density and temperature fluctuations were observed.

4380 Self-consistent radial sheath. Hazeltine, R.D. (Institute for Fusion Studies and Department of Physics, University of Texas at Austin, Austin, Texas 78712 (US)). *Physics of Fluids B: Plasma Physics (USA),* 1(10): 2031-2039 (Oct 1989).

The boundary layer arising in the radial vicinity of a tokamak limiter is examined, with special reference to the TEXT tokamak [Nucl. Fusion **27**, 1125 (1987); Phys. Fluids **27**, 2956 (1984)]. It is shown that sheath structure depends upon the self-consistent effects of ion guiding-center orbit modification as well as the radial variation of $E \times B$-induced toroidal rotation. Reasonable agreement with experiment is obtained from an idealized model, which, however simplified, preserves such self-consistent effects. It is argued that the radial sheath, which occurs whenever confining magnetic field lines lie in the plasma boundary surface, is an object of some intrinsic interest. It differs from the more familiar axial sheath because magnetized charges respond very differently to parallel and perpendicular electric fields.

4381 Quasilinear diffusion modeling of the alpha-loss-cone instability in a tandem-mirror reactor. Ho, S.K. (Fusion Studies Laboratory, Department of Nuclear Engineering, University of Illinois, Urbana, Illinois 61801 (US)); Smith, G.R.; Miley, G.H. *Physics of Fluids B: Plasma Physics (USA),* 1(10): 2040-2049 (Oct 1989).

The anisotropic loss-cone distribution of fusion-born alpha particles in a mirror system is capable of destabilizing low-frequency plasma waves. A one-and-one-half-dimensional quasilinear diffusion model is developed to study the nonlinear evolution of the alpha distribution function resulting from enhanced diffusion in velocity space and radial position driven by the unstable Alfven wave. It is found that pitch-angle scattering of the resonant alphas into the loss cone causes significant losses while radial losses are negligible for a reactor-size plasma. For a typical tandem-mirror reactor, the alpha plasma heating is greatly reduced and ignition in the central cell cannot be achieved.

4382 Observation of a stable high-beta axisymmetric plasma equilibrium. Kuthi, A. (Department of Physics, University of California, Los Angeles, California 90024 (US)); Zwi, H.; Schmitz, L.; Wong, A.Y. *Physics of Fluids B: Plasma Physics (USA),* 1(10): 2054-2057 (Oct 1989).

Stable, steady-state plasma equilibrium is generated in an axisymmetric configuration. The diamagnetic current is maintained by electromagnetic fields rotating in the electron diamagnetic sense. The stable, free-standing equilibrium exists for all values of beta up to 0.98, limited only by the available rf power. The plasma is centered on the axis well removed from the metal chamber walls, the limiters, and the rf antenna. The equilibrium pressure balance, $\mathbf{J} \times \mathbf{B} = \text{grad } p$, is quantitatively verified. Radial profiles of pressure and magnetic field show that the equilibrium is that of a rigid rotor.

4383 Visible imaging of edge fluctuations in the TFTR tokamak. Zweben, S.J. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08543 (US)); Medley, S.S. *Physics of Fluids B: Plasma Physics (USA),* 1(10): 2058-2065 (Oct 1989).

Images of the visible light emission from the inner wall region of the TFTR tokamak [M. G. Bell *et al.*, in *Plasma Physics and Controlled Nuclear Fusion Research 1988*, Proceedings of the 12th International Conference, Nice, France (IAEA, Vienna, in press)] have been made using a rapidly gated, intensified TV camera. Strong "filamentation" of the neutral deuterium D_α light is observed when the camera gating time is <100 μsec during neutral-beam-heated discharges. These turbulent filaments vary in position randomly versus time and have a poloidal wavelength of $\approx$3–5 cm, which is much shorter than their parallel wavelength of $\approx$100 cm. A second and new type of edge fluctuation phenomenon, which is called a "merfe," is also described. Merfes are a regular poloidal pattern of toroidally symmetric, small-scale marfes that move away from the inner midplane during the current decay after neutral beam injection. Some tentative interpretations of these two phenomena are presented.

4384 Relativistic dynamics of electrons in intense laser fields. Bardsley, J.N. (Lawrence Livermore National Laboratory, Livermore, California 94550 (US)); Penetrante, B.M.; Mittleman, M.H. *Physical Review [Section] A: General Physics (USA),* 40(7): 3823-3835 (1 Oct 1989). DOE Contract W-7405-ENG-48.

Following a brief review of the analytic solution for the relativistic motion of a single electron in a pulse of very strong plane-wave radiation, numerical simulations are presented that probe the effects of space-charge forces and spatial inhomogeneity of the radiation upon the one-electron dynamics. The nonlinearities introduced by relativistic effects can lead to irregular dynamics. For pulses with a smoothly varying temporal envelope the behavior of electrons that are ionized during the pulse can be very different from that of ambient electrons. The calculations support the use of short-pulsed lasers to produce high-energy electrons and incoherent x rays, but reveal possible difficulties in the formation of cold overionized plasmas suitable for recombination lasers.

4385 Free-energy expressions for Vlasov equilibria. Morrison, P.J. (Department of Physics, The University of Texas at Austin, Austin, Texas 78712 (US)); Pfirsch, D. *Physical Review [Section] A: General Physics (USA),* 40(7): 3898-3910 (1 Oct 1989).

Hamiltonian or variational formulations of the Maxwell-Vlasov equation naturally yield expressions for the free energy available upon perturbation of an equilibrium. The noncanonical Hamiltonian, Hamilton-Jacobi, and Lagrangian formulations are used to obtain such expressions. It is concluded that all interesting equilibria are either linearly unstable or possess negative-energy modes.

7002 Fusion Power Plant Technology

Refer also to citation(s) 2493, 2557, 2710, 2805, 2944, 2979, 3172, 3311, 3312, 4179, 4352, 4359, 4360, 4362, 4365, 4366

4386 (CEA-CONF–9800) **Implosion symmetry and stability.** Holstein, P.A.; Meyer, B. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1988. 55p. (CONF-8809415–: International School of Plasma Physics, Varenna (Italy), 6-16 Sep 1988). Order Number DE90721239. Available from NTIS (US Sales Only), PC A04/MF A01.

Theoretical models and experimental results on the supression of non-uniformities sources and the control of the Rayleigh-Taylor instabilities growth, in laser-driven thermonuclear fusion, are shown. The experiments made with imposed laser non-uniformities have demonstrated that the smoothing is improved with increasing laser

irradiance and with long laser wavelengths. The irradiation configuration of a sphere by N beam, the smoothing of the laser focal spots and the smoothing by thermal conduction and x radiation are discussed. The experimental results made with imposed laser nonuniformities show that with increasing laser irradiance and long laser wavelengths the smoothing is improved. In the implosion stability study, the basic picture of fluid instabilities, simulations, the growth rate determination with corrugated targets and mixing measurements with bilayer targets are analyzed.

4387 (CONF-891007–31) **The International Thermonuclear Experimental Reactor configuration evolution.** Lousteau, D.C.; Nelson, B.E.; Lee, V.D.; Thomson, S.L.; Miller, J.M.; Lindquist, W.B. Oak Ridge National Lab., TN (USA). [1989]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002150. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The International Thermonuclear Experimental Reactor (ITER) conceptual design activities consist of two phases: a definition phase, completed in September 1988, and a design phase, now in progress. The definition phase was successful in identifying a consistent set of technical characteristics and the broad definition of the required reactor configuration and hardware. Scheduled for completion in November 1990, the design phase is producing a more detailed definition of the required components, a first cost estimate, and a description of site requirements. A major activity in the ITER design phase is the period of joint work conducted at the Max Planck Institute for Plasma Physics, Garching, Federal Republic of Germany, from June through October 1989. An official report of the findings and conclusions of this activity will be submitted to and published by the International Atomic Energy Agency (IAEA). This paper highlights the evolution of the reactor mechanical configuration since the conclusion of the definition phase. 8 figs., 2 tabs.

4388 (CONF-891007–72) **The ORNL plasma fueling program.** Gouge, M.J.; Milora, S.L.; Foster, C.A.; Combs, S.K.; Fisher, P.W.; Tsai, C.C.; Argo, B.E.; Barber, G.C.; Baylor, L.R.; Fehling, D.T.; Foust, C.R.; Jernigan, T.C.; Qualls, A.L.; Schechter, D.E.; Simmons, D.W.; Sohns, C.W.; Sparks, D.O. Oak Ridge National Lab., TN (USA). [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002470. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) has been developing pellet injectors for over ten years. These devices produce frozen hydrogen isotope pellets and then accelerate the projectiles to speeds in the km/s range by either pneumatic or mechanical techniques. A variety of designs have been developed, including single-shot guns, multiple-shot guns, machine guns, and centrifugal accelerators. These injectors have been used to inject hydrogen and deuterium pellets into plasmas on numerous tokamak experiments resulting in improved plasma performance. ORNL has recently provided pellet fueling systems for the Tokamak Fusion Test Reactor (TFTR), the Joint European Torus (JET), and the Tore Supra tokamak. This paper discusses developments on these injector designs. 10 refs.

4389 (CONF-891007–75) **Graphite as a plasma-facing material in fusion experiments.** Langley, R.A. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002464. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Graphite is now used extensively in most of the major fusion experiments in the world and will be used more extensively in future devices. In addition to its excellent tolerance of high heat fluxes, graphite has many unusual characteristics that pertain to its use as a plasma-facing material; these are its propensity for releasing gases when heated and when exposed to ion fluxes, its ability to absorb copious quantities of hydrogen during hydrogen bombardment, and its ability to pump hydrogen after noble gas bombardment. The graphite used in existing machines and considered for use in future machines is isotropic on a macroscopic scale and anisotropic on a microscopic scale; it has a large open porosity, up to 20%. This leads to enormous internal surface areas for adsorption and desorption of gases. Most early hydrogen-graphite interaction experiments were incorrectly analyzed because of this property. In addition, interaction of energetic hydrogen ions with graphite can lead to erosion, with concomitant deposition of carbon films with high hydrogen content on chamber surfaces. These effects are observed experimentally and have been modeled with some success. This paper presents experimental data dealing with these topics and their influences on present-day plasma operations and on graphite use in future machines. 34 refs., 8 figs., 1 tab.

4390 (CONF-891007–77) **Location and repair of air leaks in the ATF [Advanced Toroidal Facility] vacuum vessel.** Schwenterly, S.W.; Gabbard, W.A.; Schaich, C.R.; Yarber, J.L. Oak Ridge National Lab., TN (USA). 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002488. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

On the basis of partial pressure rate-of-rise and base pressure measurements, it was determined that the Advanced Toroidal Facility (ATF) vacuum vessel had an air leak in the low 10^{-4} mbar-ℓ/s range. Pinpointing this leak by conventional helium leak-checking procedures was not possible, because large portions of the outside of the vessel are covered by the helcial field coils and a structural shell. Various alternative leak-detection schemes that were considered are summarized and their advantages and disadvantages noted. In the method ultimately employed, gun-rubber patches of various sizes ranging from 12.7 by 12.7 cm to 20.3 by 30.5 cm were positioned on the inside surfaces of the vessel and evacuated by the leak detector (LD). After roughly 5% of the surface was inspected in this way, a leak of $> 10^{-5}$ mbar-ℓ/s was discovered and localized to an area of 5 by 5 cm. Dye penetrant applied to this area disclosed three pinholes. Two small slag pockets were discovered while these points were being ground out. After these were rewelded, no furthered leakage could be found in the repaired area. Global leak rates measured after the machine was reevacuated indicated that this leak was about 30% of the overall leak rate. 1 ref., 5 figs., 1 tab.

4391 (CONF-891007–78) **Equilibrium shape control in CIT [Compact Ignition Tokamak] PF [poloidal field] design.** Strickler, D.J.; Pomphrey, N.; Jardin, S.C. Oak Ridge National Lab., TN (USA). 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002487. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The free-boundary equilibrium code VEQ provides equilibrium data that are used by the Tokamak Simulation Code (TSC) in design and analysis of the poloidal field (PF) system for the Compact Ignition Tokamak (CIT). VEQ serves as an important design tool for locating the PF coils and defining coil current trajectories and control systems for TSC. In this paper, VEQ and its role in the TSC analysis of the CIT PF system are described. 7 refs., 5 figs., 6 tabs.

4392 (CONF-891007–83) **An assessment of the lifetime of Faraday shield elements.** Caughman, J.B.O. II; Ruzic, D.N.; Hoffman, D.J.; Langley, R.A.; Lewis, M.B.; Ryan, P.M. Oak Ridge National Lab., TN (USA). 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. 19X-SB359V. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002714. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The interaction of plasma with rf fields from an ion cyclotron range of frequencies (ICRF) antenna has been studied to estimate the amount of Faraday shield erosion expected in normal ICRF heating operation. Plasma parameters and ion energies have been measured in the near field of an antenna and used in a model to estimate the erosion rate of the Faraday shield surface. Experiments were conducted on the RF Test Facility, a magnetic mirror device at Oak Ridge National Laboratory, using a single-strap resonant loop antenna with a two-tier Faraday shield. The outer tier, facing the plasma, was layered with graphite tiles. The antenna was operated at currents and voltages within 50% of those expected in tokamaks. The time-varying floating potential was measured with a

capacitively coupled probe, and the time-averaged floating potential, electron temperature, and electron density were measured with Langmuir probe. Both probes were scanned in front of the antenna. Ion energies were measured with a gridded energy analyzer located below the antenna, and samples of silicon were placed on the Faraday shield surface to estimate the incident ion energy. The capacitive probe measurement show that the rf floating potential follows the magnetic field pattern of the antenna, indicating that the electromagnetic fields are responsible for the potential formation. Electron temperatures increase with rf power and can reach values $\geq$60 eV for an rf power of ~25 kW. Incident ion energies $\geq$300 eV have been measured for the same power level. Predictions of light ion sputtering of candidate Faraday shield materials are presented. 19 refs., 6 figs., 1 tab.

4393 (CONF-891007–84) **The Breeding Blanket Interface (BBI) and the Tritium Systems Test Assembly (TSTA).** Sze, D.K.; Finn, P.A.; Clemmer, R.G.; Anderson, J.L.; Bartlit, J.R.; Sherman, R.; Naruse, Y.; Yoshida, H.; Okuno, K.; Enoeda, M. Argonne National Lab., IL (USA). Oct 1989. 5p. Sponsored by U.S. DOE Energy Research; Japan Atomic Energy Research Institute. DOE Contract W-31109-ENG-38. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002848. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Tritium System Test Assembly (TSTA) project at Los Alamos National Laboratory is charged with developing and demonstrating the fusion fuel processing requirement for the magnetic fusion energy program. The key fusion fuel streams are the plasma exhaust and the blanket stream. At present, the technology under development at TSTA includes only the plasma exhaust. The blanket is a logical upgrade to TSTA. This possible upgrade is the subject of an ongoing study among LANL, JAERI, and Argonne National Laboratory (ANL). This program, called The Breeding Blanket Interface (BBI), is being investigated with the intention of installing such a processing system at TSTA in the 1992–1993 time frame. The BBI program was initiated in July 1987. The conditions of the tritium product streams of various blankets were determined. Preconceptual designs of the BBI systems were developed for two blanket concepts: Aqueous Lithium Salt Solution Blanket and Solid Breeder Blanket. Preliminary estimates of costing and the schedule of the TSTA/BBI program have been developed. This paper covers the schedule and planning of the TSTA/BBI program. The goal of the program is to establish the engineering data basis of the fuel cycle for an ITER type machine. The operation of the TSTA/BBI hardware is expected to cover the period of 1993 to 1996. 9 refs., 2 figs., 3 tabs.

4394 (CONF-891007–85) **Preliminary design of the CIT [Compact Ignition Tokamak] cryostat.** Goins, M.L. Oak Ridge National Lab., TN (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90002710. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

For the Compact Ignition Tokamak (CIT) to achieve the performance goals set forth, the toroidal field (TF) and poloidal field (PF) coil systems must operate in a cryogenic temperature regime. The cryostat has been designed to provide and maintain this environment. The preliminary design activity is addressing the design issues and interfaces necessary to provide a cryogenic vessel that will maintain a maximum temperature differential of 8°C between the outer vessel wall and the ambient test cell conditions; operate in a pressure range of +5 psig to −2 psig; accommodate numerous penetrations, including cooling, diagnostic, and gravity support items; and maintain a maximum leak rate of gaseous nitrogen at 1 l/s at 1 atm. Conceptually, the cryostat consists of thermal insulation sandwiched between an inner primary stainless steel pressure vessel and a thin outer stainless steel wall. Design activities have concentrated on determining the size and shape of the primary vessel wall and selecting the best candidate thermal insulation materials for future irradiation testing. The following shapes of the upper and lower cryostat structure were analyzed: a standard ASME torispherical domed top and bottom; a nonstandard domed top and bottom; and a 2° sloped conical top and bottom contour. Screening of candidate insulation materials was based on lowest thermal conductivity over the range of temperatures anticipated in the CIT environment; low material cost and apparent ease of assembly; and survivability of material in the CIT irradiation environment. This paper presents the configuration development of the cryostat used to maintain the cryogenic temperature environment for CIT. 3 refs., 3 figs., 3 tabs.

4395 (CONF-891007–88) **Potential minimum cost of electricity of superconducting coil tokamak power reactors.** Reid, R.L.; Peng, Y-K. M. Oak Ridge National Lab., TN (USA). [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90003077. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The potential minimum cost of electricity (COE) for superconducting tokamak power reactors is estimated by increasing the physics (confinement, beta limit, bootstrap current fraction) and technology [neutral beam energy, toroidal field (TF) coil allowable stresses, divertor heat flux, superconducting coil critical field, critical temperature, and quench temperature rise] constraints far beyond those assumed for ITER until the point of diminishing returns is reached. A version of the TETRA systems code, calibrated with the ITER design and modified for power reactors, is used for this analysis, limiting this study to reactors with the same basic device configuration and costing algorithms as ITER. A minimum COE is reduced from >200 to about 80 mill/kWh when the allowable design constraints are raised to 2 times those of ITER. At 4 times the ITER allowables, a minimum COE of about 60 mill/kWh is obtained. The corresponding tokamak has a major radius of approximately 4 m, a plasma current close to 10 MA, an aspect ratio of 4, a confinement H- factor $\leq$3, a beta limit of approximately 2 times the first stability regime, a divertor heat flux of about 20 MW/m^2, a $B_{max} \leq 18$ T, and a TF coil average current density about 3 times that of ITER. The design constraints that bound the minimum COE are the allowable stresses in the TF coil, the neutral beam energy, and the 99% bootstrap current (essentially free current drive). 14 refs., 4 figs., 2 tabs.

4396 (CONF-891093–9) **Acceleration of small, light projectiles (including hydrogen isotopes) to high speeds using a two-stage light gas gun.** Combs, S.K.; Foust, C.R.; Gouge, M.J.; Milora, S.L. Oak Ridge National Lab., TN (USA). 1989. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 36. American Vacuum Society national vacuum symposium; Boston, MA (USA); 23-27 Oct 1989. Order Number DE90002479. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Small, light projectiles have been accelerated to high speeds using a two-stage light gas gun at Oak Ridge National Laboratory. With 35-mg plastic projectiles (4 mm in diameter), speeds of up to 4.5 km/s have been recorded. The "pipe gun" technique for freezing hydrogen isotopes in situ in the gun barrel has been used to accelerate deuterium pellets (nominal diameter of 4 mm) to velocities of up to 2.85 km/s. The primary application of this technology is for plasma fueling of fusion devices via pellet injection of hydrogen isotopes. Conventional pellet injectors are limited to pellet speeds in the range 1-2 km/s. Higher velocities are desirable for plasma fueling applications, and the two-stage pneumatic technique offers performance in a higher velocity regime. However, experimental results indicate that the use of sabots to encase the cryogenic pellets and protect them for the high peak pressures will be required to reliably attain intact pellets at speeds of $\approx$3 km/s or greater. In some limited tests, lithium hydride pellets were accelerated to speeds of up to 4.2 km/s. Also, repetitive operation of the two-stage gun (four plastic pellets fired at $\approx$0.5 Hz) was demonstrated for the first time in preliminary tests. The equipment and operation are described, and experimental results and some comparisons with a theoretical model are presented. 17 refs., 6 figs., 2 tabs.

4397 (CONF-8905112–2) **A semiautomated computer-interactive dynamic impact testing system.** Alexander, D.J.; Nanstad, R.K.; Corwin, W.R.; Hutton, J.T. Oak Ridge National Lab., TN (USA). [1989]. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From ASTM symposium on the applications of automation technology to fatigue and fracture testing; Kansas City, MO (USA); 22-23 May 1989. Order Number

DE90002721. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A computer-assisted semiautomated system has been developed for testing a variety of specimen types under dynamic impact conditions. The primary use of this system is for the testing of Charpy specimens. Full-, half-, and third-size specimens have been tested, both in the lab and remotely in a hot cell for irradiated specimens. Specimens are loaded into a transfer device which moves the specimen into a chamber, where a hot air gun is used to heat the specimen, or cold nitrogen gas is used for cooling, as required. The specimen is then quickly transferred from the furnace to the anvils and then broken. This system incorporates an instrumented tup to determine the change in voltage during the fracture process. These data are analyzed by the computer system after the test is complete. The voltage-time trace is recorded with a digital oscilloscope, transferred to the computer, and analyzed. The analysis program incorporates several unique features. It interacts with the operator and identifies the maximum voltage during the test, the amount of rapid fracture during the test (if any), and the end of the fracture process. The program then calculates the area to maximum voltage and the total area under the voltage-time curve. The data acquisition and analysis part of the system can also be used to conduct other dynamic testing. Dynamic tear and precracked specimens can be tested with an instrumented tup and analyzed in a similar manner. 3 refs., 7 figs.

4398 (CONF-8906236–1) **Control of ash accumulation by induced-fishbones.** Varadarajan, V.; Miley, G.H. Illinois Univ., Urbana, IL (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER52127. From ARIES meeting; Boston, MA (USA); Jun 1989. Order Number DE90001565. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Thermal alphas will accumulate in the ignited long pulse tokamak. Ash accumulation results in fuel dilution, reduced power output, increase in Z_{eff}, and increased synchrotron losses. Recent 'Baldur' simulations of the ITER show that the ash accumulation is a distinct possibility for high ash recycling case, inevitably leading to burn quench. So, some means of ash is highly desirable. To this end, several control schemes have been looked at. Given the uncertainty in transport information especially for the ash and other impurity transport, it is desirable to incorporate some explicit ash control features in the tokamak design. Continuing the search for more desirable schemes, in this paper we explore the effectiveness of 'fishbones' towards controlling the alpha accumulation.

4399 (DOE/ER/53192–40) **Design of the Compact Auburn Torsatron: [Annual performance report].** Gandy, R.F.; Henderson, M.A.; Hanson, J.D.; Schneider, T.; Swanson, D.G.; Cary, J.R. Auburn Univ., AL (USA). Aug 1989. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-85ER53192. Order Number DE90002543. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper describes the design and optimization procedure for the Compact Auburn Torsatron. Included in this is a description of the Cary-Hanson Optimization technique. In this paper the properties of the magnetic fields are presented and a description of the machine and the construction procedure. The experimental setup for the surface mapping is described and conclusions are presented. 10 refs., 9 figs., 1 tab.

4400 (DOE-tr–89-5) **Basic research results on controlled thermonuclear fusion and plasma physics in the USSR between July 1987 and July 1988.** USDOE, Washington, DC (USA). 1988. 49p. Translation source information not available. Sponsored by U.S. DOE Management & Administration. Order Number DE90002743. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses research being done on tokamaks and stellarators in the USSR. Plasma heating, magnetic field configuration, ion traps, and design are some of the area discussed. (LSP)

4401 (DOE-tr–89-7) **Status of work on TSP, T-15 and other OTR units.** Glukhikh, V.A. USDOE, Washington, DC (USA). 1988. 34p. Translation source information not available. Sponsored by U.S. DOE Management & Administration. Order Number DE90002744. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper discusses the work done on the TSP, T-15, and OTR tokamak. The strong fields and adiabatic plasma compression is discussed on TSP. The work done on components like the cryogenic system and power system are discussed on T-15. The parameters and designs are discussed on the OTR. (LSP)

4402 (DOE-tr–89-39) **The status of work on the ITER project in the USSR.** Sokolov, Y.A. USDOE, Washington, DC (USA). [1989]. 23p. Translation source information not available. Sponsored by U.S. DOE Management & Administration. Order Number DE90002749. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The report discusses the progress on the ITER tokamak by the USSR and the cooperation by the USA and the USSR on other fusion research. (LSP)

4403 (DOE-tr–89-46) **Agreement between the USSR State Committee on the Use of Nuclear Power and the Department of Energy of the USA regarding joint studies in the field of controlled thermonuclear fusion and plasma physics.** USDOE, Washington, DC (USA). 1989. 17p. Translation source information not available. Sponsored by U.S. DOE Management & Administration. Order Number DE90002751. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report discusses the agreement between the USSR State Committee on the Use of Nuclear Power and the Department of Energy of the USA regarding joint studies in the field of controlled thermonuclear fusion and plasma physics. The purpose of this cooperation is to perform research aimed at developing fusion energy as an inexpensive, ecologically pure and practically inexhaustible source of energy for the benefit of all mankind. The cooperation may include theoretical, computational and experimental research, as well as studies on joint coordination and the corresponding measures.

4404 (EGG-M–36587) **Heat transfer in condensation of lithium vapors.** Oh, C.H.; Wadkins, R.P. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-880139–5: 26. AIAA aerospace conference, Reno, NV (USA), 10-14 Jan 1988). Order Number DE90002081. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents the results of an experimental investigation into lithium condensation. The objective of the investigation is to find the condensing side heat transfer coefficients of lithium on the vertical flow configuration and to explain the discrepancy between the Nusselt's theory and experimental results. The heat fluxed in these experiments varied from about 1.3×10^4 W/m^2 at 833 k to 1.3×10^5 W/m^2 at 898 k, giving heat transfer coefficients of 4078 W/m^2 k to 37805 W/m^2 k. These values appear 0.3% to 3% of those predicted by the Nusselt theory. Condensate film thickness was calculated by the Nusselt theory. Boiling and condensing of lithium at low, less than atmospheric pressure, appears to be an efficient energy transport mechanism that may find use in space applications or cooling of the first wall in fusion reactors. 19 refs., 5 figs.

4405 (EGG-M–88260) **Critical safety function guidelines for experimental fusion facilities.** Cadwallader, L.C. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC07-76ID01570. (CONF-881031–77: 8. topical meeting on technology of fusion energy, Salt Lake City, UT (USA), 9-13 Oct 1988). Order Number DE90002094. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

As fusion experiments proceed toward deuterium-tritium operation, more attention is being given to public safety. This paper presents the four classes of functions that fusion experiments must provide to assure safe, stable shutdown and retention of radionuclides. These functions are referred to as critical safety functions (CSFs). Selecting CSFs is an important step in probabilistic risk assessment (PRA). An example of CSF selection and usage for the Compact Ignition Tokamak (CIT) is also presented. 10 refs., 6 figs.

4406 (EGG-M–88268) **Atmospheric detritiation system performance.** Longhurst, G.R.; Jalbert, R.A.; Rossmassler, R.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC07-76ID01570.

(CONF-881031–74: 8. topical meeting on technology of fusion energy, Salt Lake City, UT (USA), 9-13 Oct 1988). Order Number DE90002053. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An investigation of the performance of atmospheric detritiation systems and of possible ways for improving their performance was undertaken. Small-scale experiments demonstrated that system performance is strongly dependent on catalyst bed temperature. That may be helped by addition of protium to the process gas stream, but added protium at constant temperature does not increase conversion to HTO. Collection of the HTO on dry sieve with residual HTO fraction of less than one part in 10^7 was observed. Ways suggested for improvement in collection of HTO on molecular sieve beds include adding H_2O to the stream entering the molecular sieve and premoistening of the sieve with H_2O. While these improvement schemes may reduce HTO emissions they increase the amount of tritiated waste that must be handled. 13 refs., 4 figs.

4407 (GA-A–19739) **Mechanical design of the Inside Launch system for electron cyclotron heating in DIII-D.** Hoffmann, E.H.; Moeller, C.P.; Prater, R. General Atomics, San Diego, CA (USA). Nov 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-891007–94: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90003292. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A description is presented of the elements which form a transmission and launching system for the 2 MW ECH Inside Launch experiment on the DIII-D tokamak. The design of various system components, such as mode converters, waveguide bends, couplings, split waveguides, and launching mirrors are described. The DIII-D ECH system has ten gyrotrons which each produce 200 kW of power at 60 GHz. Each gyrotron has its own run of waveguide, about 46 m in length, to connect it to a vacuum window at the tokamak. A taper after the window reduces the diameter of the waveguide to the size that meets the requirements of the vacuum vessel port. A split waveguide which is electrostatically biased carries the microwave power across the location of the magnetic field resonance. The launch point is at the centerpost at midplane. The launching mirrors are adjustable to different angles of injection. 3 refs., 3 figs.

4408 (GA-A–19740) **An interior vessel viewing system for DIII-D.** Senior, R. General Atomics, San Diego, CA (USA). Nov 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-891007–96: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90003364. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

It was anticipated that there could be damage to the interior walls of the vacuum vessel during operations of the DIII-D tokamak. A method of viewing the inside of the vessel from the outside was required, that would allow the interior walls to be inspected visually for damage and to locate any debris resulting from operations. A miniature closed circuit television color camera system was developed which could be inserted into one of several ports of the vessel during a 'clean' vent, i.e., vented to inert gas. The system has pan, tilt and zoom capability and carries its own lighting. The use of this system allows a quick assessment of the condition of the vessel to be made under 'clean' vent conditions. This precludes the need for the permit process and manned entry into the vessel which would allow air inside the vessel. A permanent record of the inspection can then be made on video tape. The design and configuration of this camera system is presented and its use as a diagnostic tool discussed. 2 refs., 5 figs.

4409 (GA-A–19741) **Upgrade plans to handle 30 to 40 Mbytes of data for DIII-D.** Henline, P. General Atomics Co., San Diego, CA (USA). Nov 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-891007–93: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90003291. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Department of Energy funds the DIII-D tokamak program which carries out plasma physics and fusion energy research experiments. The machine began operations in February 1986; at that time, approximately 7 Mbytes of data was collected for each shot. Since that time, the shot size has steadily increased to a maximum of over 30 Mbytes. The average shot size is now about 25 Mbytes and over 1 Gigabyte of data has been collected during some operation day. The computer systems were designed to handle a maximum shot size of 25 Mbytes. In order to meet the increased demands, changes to hardware and software are being made and each experiment reviewed before being added to a shot. The area of data transfer now increasing the most is data transferred from small diagnostic DEC VAX systems to the main VAX cluster. Plans in this area include upgrading the VAX which receives data (possibly to a VAX 6310) to have both more CPU power and a faster interface to the Network Systems Hyperchannel which transfers data to the VAX. The new machine will be more easily upgraded with additional CPU's, communication devices and storage devices. Software changes are being incorporated on diagnostic VAXes so that subsets of data, or calculated results are included with the shot data file, rather than the often large (6 to 20 Mbytes) amount of data collected locally. More careful examination is being given to all experiments added to the tokamak, and only necessary and useful data is being added to the system for permanent storage. 4 refs.

4410 (GA-A–19742) **Design of DIII-D Advanced Divertor.** Smith, J.P.; Baxi, C.B.; Reis, E.; Schaffer, M.; Thurston, G. General Atomics, San Diego, CA (USA). Nov 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-891007–95: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90003343. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Advanced Divertor is a modification being designed for the plasma chamber of the DIII-D tokamak in order to optimize the divertor configuration and allow a broader range of experiments to be carried out. The Advanced Divertor will enable two classes of physics experiments to be run in DIII-D: Divertor biasing and Divertor baffling. The Advanced Divertor has two principal components: a toroidally symmetric baffle; and a continuous ring electrode. The tokamak can be run in baffle, bias, or standard DIII-D divertor modes by accurate positioning of the outer divertor strike point through the use of the DIII-D plasma control system. The baffle will contain approximately 50,000 l/s pumping for particle removal in the outer bottom corner of the vacuum vessel. The strike point will be positioned at the entrance aperture for the baffle mode. The aperture geometry is designed to facilitate a large particle influx plus a high probability that backstreaming particles will be reionized and redirected to the aperture. Where the baffling plates meet, gas sealing is required to prevent recycling of neutrals back into the plasma. The electrode is a continuous water-cooled ring, armored with graphite. The ring is electrically isolated from the vessel wall and is biasable to 1 kV and 20 kA. The outer leg of the divertor will be positioned on the graphite covered ring during biasing experiments. The supports for the ring are radially flexible to handle the differential thermal growth between the ring and the vessel wall but stiff in the vertical direction to restrain the ring against large disruption forces. The coolant and electrical feeds are designed in a similar manner. All the feeds are supported from and maintain a 5 kV isolation to the vessel wall. 2 refs., 4 figs.

4411 (GA-A–19747) **DIII-D cryogenic control system upgrade.** Campbell, G.L.; Gilgallon, J.J. General Atomics, San Diego, CA (USA). Nov 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-891007–92: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90003290. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The helium liquefier and distribution system at the DIII-D tokamak facility has been upgraded with the addition of a programmable logic controller, color graphic operator interfaces and analog data acquisition system. This new system provides extended monitoring, control capability as well as centralized datalogging, trending and alarm reporting. Other objectives included offsite (remote) monitoring and control via phone modem and a hardware basis for automation of liquefier operation and maintenance. It is now also possible to accomplish connection and coordination with other DIII-D control systems. It was required that most of the installation and

checkout of the new control system be done during operating periods. For this reason, and reliability concerns, the upgrade hardware was designed and installed as an additional independent system rather than a replacement control system. 5 figs.

4412 (GA-A–19748) **Data file management in the DIII-D data acquisition and analysis computer systems.** McHarg, B.B. Jr. General Atomics, San Diego, CA (USA). Nov 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-891007–91: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90003289. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

DIII-D is a large tokamak plasma physics and fusion energy research experiment funded by the Department of Energy. Each shot of the experiment results in data files containing between 20 and 30 Mbytes of data. These shots occur about once every 10 minutes with 40 to 50 shots per operating day. Over 1.2 gigabytes have been acquired in one daily session. Most of this data is acquired by MODCOMP Classic computers and is transferred via a Network Systems Hyperchannel to the DIII-D DEC VAX cluster system which is connected via Ether-net to the User Service Center DEC VAX cluster system. Some other data is acquired by local MicroVAX based plasma diagnostic systems and is transferred via DECnet to the DIII-D cluster. A substantial part of these VAX cluster systems is devoted to handling the large data files so as to maintain availability of the data for users, provide for shot archiving and shot restoration capabilities, and at the same time allow for new data to be received into the systems. Many of these tasks are carried out in near real time in sequence with a tokamak shot while other tasks are performed periodically throughout operations or during off hours. These tasks include disk space management, data archiving to 6250 and/or 8 mm tape drives, data file migration from the DIII-D cluster to the User Service Center cluster, data file compression, and network wide data file access. 11 refs., 2 figs.

4413 (GA-A–19751) **DIII-D F-coil chopper selection, control and fault recognition system.** Burley, B.L.; Smith, T.L. General Atomics, San Diego, CA (USA). Nov 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-891007–90: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90003288. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The DIII-D fusion experiment uses 18 field-shaping coils (F-coils) to control position and shape of a plasma discharge. The DIII-D F-coils are powered and controlled by configuring single or parallel operation of up to 50 modular, 3 kAmp, 3 kHz, 2 quadrant switching switching power supplies (choppers) and 9 dc power supplies. The dc power supplies provide the raw power for the choppers while the choppers control the current in the F-coils. Through the use of a special high current patch panel, any similar (600 V or 1200 V) chopper can be connected to any of the 18 F-coils. This allows efficient reassignment of power supplies for a variety of fusion experiments. The control system for such a flexible system must also allow the quick reassignment of chopper controls and incorporate a fault detection system to protect power supplies and the fusion experiment. The Chopper Selection, Control, and Fault Recognition system meets this need through the use of state-of-the-art computer bus switching networks and programmable array logic (PAL) circuitry. The chopper selection and control system uses computer bus switching networks to select individual chopper controls for a specific F-coil. Thumbwheel switches identified for specific DIII-D F-coils are used to program the selection of each chopper power supply. A single coil and the controls for that coil can be connected to 1 or all of the chopper power supplies. In practice no more than 6 chopper power supplies are assigned to any single F-coil. 3 refs., 2 figs.

4414 (GA-A–19752) **Mechanical design of an infrared imaging system for DIII-D.** Tabor, M.A.; Petrie, T.W. General Atomics, San Diego, CA (USA). Nov 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-891007–89: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90003287. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Two infrared imaging units have been designed to monitor temperature changes on the protective armor tile inside the DIII-D vacuum vessel. Each imaging unit includes an optical system (lenses, mirrors, and infrared camera), a support structure, and a magnetic shield enclosure. Each optical system requires a 45° field-of-view to monitor a large area within the vacuum vessel. The quality of the image produced by the infrared camera is very sensitive to mechanical vibrations. A rigid support structure has been designed to minimize the motion of the optical system and camera image during a plasma experiment. First, the vibration characteristics of an existing DIII-D imaging unit support structure were measured. The structural properties of the proposed imaging unit supports were then determined using CAD/CAM modeling and finite element analysis and were modified until their stiffnesses matched or exceeded the stiffness of the existing structure. This method eliminated a detailed static and dynamic analysis of all the forces acting on the proposed structures. 5 refs., 6 figs., 2 tabs.

4415 (GA-A–19756) **Beam current regulation of DIII-D neutral beam long pulse ion sources.** Hong, R.; Kellman, D.; Santamaria, G.; Colleraine, A.; Kim, J.; Lee, R.; Phillips, J.; Wight, J. General Atomics, San Diego, CA (USA). Nov 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. /CONF-891007–86: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002914. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

An intrinsic characteristic of the neutral beam long pulse ion source installed on the DIII-D tokamak is the slow increase of arc and beam currents during the beam pulse. This ramping is attributed to the heating of the filaments by energetic electrons backstreaming from the accelerator into the arc chamber. The corresponding change in beam perveance causes the beam optics to vary during a beam pulse, often resulting in an overdense condition. A technique which employs the idea of compensating the filament temperature rise by stepping down the voltage applied to the filaments at beam turn-on has proved to be somewhat effective and successful in regulating the beam current. The disadvantage of this technique is that the amount of filament voltage step-down varies from source to source and is dependent on beam energy. A new technique uses a Langmuir probe signal for feedback regulation in the arc power supply. Plasma density within the arc chamber is maintained at a constant value, as is beam current. This arc regulation method also features "arc notching" at beam turn-on to provide perveance matching during initial beam formation, which is crucial to obtaining smooth initial beam extraction, a high perveance beam, and thus higher power beam operation. The beam power achieved with this arc notching and regulation technique is about 10% higher than that obtained previously with the filament voltage step-down method. 2 refs., 12 figs., 1 tab.

4416 (INDC(CCP)–301/GF) **Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987.** International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. Jul 1989. 20p. (CONF-870959–: 1. international conference on neutron physics, Kiev (USSR), 14-18 Sep 1987). Order Number DE90607489. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Translated from Russian by the IAEA.

The document contains the following two papers: "Thermonuclear Reactors and Nuclear Data Requirements" and "Neutron Leakage Spectra from Be, Pb and U Spheres at 14 MeV Energy". A separate abstract was prepared for each of these papers. Refs, fig and tabs.

4417 (IPPJ-REV–4, pp. 11-14) **High efficiency LHCD experiments on JT-60.** Imai, T. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

It is experimentally comfirmed that current drive efficiency eta_CD ($n\text{-}bar_e R_p I_{RF}/P_{LH}$ ($10^{19}m^{-2}A/W$)) proportional to $<T_e>/(Z_{eff}+5)$. High current drive efficiencies of $eta_CD \simeq 2.9$ and 2.6 are obtained with and without NB heating. The improvement of the eta_CD by the optimization of Nparallel-spectrum is also found experimentally. (author).

4418 (IPPJ-REV–4, pp. 15-18) **Steady state current drive by lower hybrid wave in TRIAM-1M.** Itoh, S. (Kyushu Univ., Fukuoka (Japan). Research Inst. for Applied Mechanics); Hiraki, N.; Nakamura, Y.; Nakamura, K.; Nagao, A.; Moriyama, S.; Jotaki, E.; Kawasaki, S. Nagoya Univ. (Japan). Inst. of Plasma Physics. Mar 1989. (CONF-881266–: US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, Kyoto (Japan), 6-8 Dec 1988). In *Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts.* Order Number DE90705940. Available from NTIS (US Sales Only), PC A06/MF A01.

Published in summary form only. TRIAM-1 TOKAMAK/non-inductive current drive; SUPERCONDUCTING COILS; LOWER HYBRID HEATING; ELECTRIC CURRENTS; IMPURITIES; METALS; PLASMA

4419 (IPPJ-T–38) **Proceedings of the Japan-U.S. workshop P-118 on vacuum technologies for fusion devices.** Miyahara, A. (ed.). Nagoya Univ. (Japan). Inst. of Plasma Physics. 1989. 317p. (CONF-8808275–: Japan-U.S. workshop P-118 on vacuum technologies for fusion devices, Nagoya (Japan), 1-5 Aug 1988). Order Number DE90719705. Available from NTIS (US Sales Only), PC A14/MF A01.

Fusion community does not appreciate vacuum technologies to the same extent as accelerator community does. This is because, in the case of accelerators, in particular storage ring systems, the requirement of attaining ultrahigh vacuum in order to avoid collisional loss is well defined, on the other hand, it is not possible to define the requirement so precisely in the case of fusion devices. One of the reasons is that core plasma interacts with vessel wall so strongly and unpredictably that it becomes difficult to identify the role played by individual components. However, in the next step and the next generation machines like CIT, LHS, ITER, FER and NET, vacuum technologies would play more significant roles, because the CIT will introduce tritium in a vacuum vessel, and the aim of the ITER project is to demonstrate particle balance, namely, to achieve steady state operation with D-T fuel. The Japan-U.S. workshop P-118 was held at the Institute of Plasma Physics, Nagoya University, from August 1 to 5, 1988. 33 participants including 4 from the U.S. took part in the workshop. In the plenary session, 12 lectures were given, and also the topics-oriented session on pumping, gauging, remote maintenance, first wall, pump limiter, divertor and others was held. (K.I.).

4420 (JAERI-M–89-018) **Low energy neutral particle energy analyser by time of flight method.** Miura, Yukitoshi; Okano, Fuminori; Matsuzaki, Yoshimi. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1989. 19p. (In Japanese). Order Number DE90719529. Available from NTIS (US Sales Only), PC A03/MF A01.

The design study of a low energy neutral particle analyser by using the time of flight method is performed. The chopper system can be made by a modified turbo molecular pump. A modified photoelectron-multiplier with a gate assembly may be suitable for the detector of this system. If a turbo molecular pump can rotate with a speed of about 40000 rpm, then the energy resolution ($\delta E/E$) of 1 keV hydrogen particles is less than 20% with the flight length of 2 m (It is assumed that the chopper radius is 50 mm and the width of a slit is 0.15 mm). (author).

4421 (JAERI-M–89-074) **Development and application of an on-line tritium production rate measuring method.** Yamaguchi, Seiya. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 123p. Order Number DE90719536. Available from NTIS (US Sales Only), PC A06/MF A01.

A sensitive on-line method for measuring the tritium production rate (TPR) of ^6Li was developed using the response difference of ^6Li and ^7Li-glass scintillators in a mixed neutron-gamma radiation field. A fitting method for subtracting the pulse height spectrum of ^7Li-glass from that of ^6Li-glass was introduced. The contribution of competing reactions such as ^6Li (n, n 'd) ^4He was estimated kinematically. An absolute value of the ^6Li content was determined by chemical analysis. The thermal flux perturbation due to ^6Li-glass of various thickness and ^6Li contents was evaluated by measurement in a thermal neutron field and calculation by the modified Skyrme theory. A Monte Carlo calculation of the self-shielding effect was made. The dependence of the self-shielding on neutron energy was examined by this Monte Carlo code. The edge effect, i.e., distortion of the pulse height spectrum due to partial energy deposition of the alpha and/or the triton, was investigated by measurement in a thermal neutron field and by a Monte Carlo simulation that was based on the scintillation mechanism and considered Bragg absorption and the ratio of contributions to luminescence by the alpha and the triton. The dependence of the edge effect on neutron energy was examined by this Monte Carlo code. This method was applied to the measurement of TPR distributions in simulated fusion blanket assemblies bombarded by D-T neutrons. Absolute values of the TPR were obtained with an experimental error of 3-6%. The measured results were compared with those of conventional β-counting methods and good agreement was obtained. An optical fiber system, using miniature lithium-glass scintillators, was fabricated for purpose of microminiaturization of detector size and adaption to strong electromagnetic field. Applicability of this system to a D-T neutron field was demonstrated. (author).

4422 (JAERI-M–89-075) **Estimation method of reionization loss in the drift ducts for JT-60 NBI.** Matsuoka, Mamoru; Akiba, Masato; Usui, Katsutomi; Oohara, Hiroshi; Ohara, Yoshihiro; Kuriyama, Masaaki; Horiike, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 24p. (In Japanese). Order Number DE90719526. Available from NTIS (US Sales Only), PC A03/MF A01.

In JT-60 the reionzation loss of neutral beams in the drift ducts is estimated using the information of ambient pressure and gas flow rate into the beam-lines. The reionzation loss was more than 50% of the injection power at the start of the injection experiments, due to the outgas from the surface of the drift ducts. However, it was found that the drift ducts were well conditioned after about 30 beam shots and the reionization loss was reduced to about 5%. (author).

4423 (JAERI-M–89-081) **Upgrade of JT-60 pellet injector for higher velocity.** Hiratsuka, Hajime; Miyo, Yasuhiko; Yoshioka, Yuji; Ohta, Kazuya; Shimizu, Masatsugu; Kawasaki, Kouzo. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1989. 38p. (In Japanese). Order Number DE90719548. Available from NTIS (US Sales Only), PC A03/MF A01.

Pellet injection experiments have been performed to improve the plasma performance by the JT-60 tokamak from June, 1988. From the results of the experiments, it was found that the plasma confinement time increased up to 40% with pellet injection (velocity over 1.5 km/s), in which was obtained with 10 MW neutral beam injection highly peaked electron density profile. The experimental results suggested that improvement of the plasma confinement time depends on the penetration depth of the pellet into the plasma column, especially into 'q<1' region. This fact require the higher pellet velocity to achieve the inproved plasma continement time. The pellet injector was upgraded to obtain the injection velocity over 1.9 km/s in the end of 1988. In this upgrade, some major components such as a pellet gun assembly, fast -opening magnetically driven values (FMV) and a part of piping line for propellent gas were replaced. The 2.3 km/s of pellet velocity has been attained by the combination of the shorter response time of the newly developed FMV from 1.1 ms to 0.5 ms, increased working pressure and temperature from 50 kg/cm^2 to 100 kg/cm^2 and from 80degC to 200degC respectively. The upgraded pellet injector can inject, independently, four pellets, two of which are 3.0 mm in diameter x 3.0 mm in length and the other two of which are 4.0 mm in diameter x 4.0 mm in length. (author).

4424 (JAERI-M–89-084) **Quick installation/removal technology for first wall.** Tachikawa, Katsuhiro; Horie, Tomoyoshi; Seki, Yasushi; Fujisawa, Noboru; Kondoh, Mitsunori; Uchida, Takao. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 75p. (In Japanese). Order Number DE90719545. Available from NTIS (US Sales Only), PC A04/MF A01.

Fusion Next Step Device (FER) plans to experiment Deutrium-Tritium (D-T) reaction, remote handling and other fusion engineering issues. The fast neutron of 14 MeV caused by D-T reaction does not only activate the structural components inside the vacuum vessel, but also damages some first walls. The technique to remove the armour tiles of first walls by simple and quick operation is a key technology for the D-T burning Next Step Device. To establish the rational remote tile handling technology, consideration of consistency between the reactor structure and remote equipments should be made. The report comprises mainly the joint structures of armour tiles, design conditions (electro-magnetic force, cooling systems and so forth) and remote equipments. In addition, it is referred in shape memory alloy (SMA) applications, transportation of damaged tiles from the vacuum vessel and inspection systems for the first wall integrity. Hereafter, furthermore study in depth for the tile handling must be made in parallel with verification of remote systems and tile attachment structures using partial mockups. (author).

4425 (JAERI-M–89-087) **ERATO-code analysis of vacuum magnetic field oscillations in JT-60 divertor configuration.** Ozeki, Takahisa; Tokuda, Shinji; Tsunematsu, Toshihide; Ishida, Shinichi; Neyatani, Yuzuru; Itami, Kiyoshi; Azumi, Masafumi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 27p. (In Japanese). Order Number DE90719607. Available from NTIS (US Sales Only), PC A03/MF A01.

Magnetic field oscillations caused by external kink instabilities are numerically studied by using the ideal MHD stability code ERATO-J. Dependence of a spatial distribution of their amplitude and phase on aspect-ratio, beta-poloidal, shaping of conducting shell and divertor/limiter configurations is examined in detail. In the low aspect ratio plasma, the amplitude of magnetic oscillations in the inner side of the torus is larger than that in the outer. On the contrary, as the poloidal beta increases, the amplitude in the outer side of the torus becomes larger than that in the inner. In the divertor configuration, the amplitude of oscillations reduces near the X-point and the phase is locally modulated. The coherent magnetic oscillations observed in JT-60 agree well with the theoretical results, where the vacuum vessel is assumed to be an ideal conducting shell. The non-uniformity of the poloidal distribution observed in JT-60 can be explained by the combined effects of the finite beta, the X-point and the shape of shell. (author).

4426 (JAERI-M–89-090) **Measurement of impurities in a volume produced H^- ion beam.** Okumura, Yoshikazu; Hanada, Masaya; Kojima, Hiroaki; Matsuda, Yasuhiro; Oohara, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1989. 17p. (In Japanese). Order Number DE90719572. Available from NTIS (US Sales Only), PC A03/MF A01.

Impurity content in a negative ion beam was measured by a momentum mass analysis and a doppler shifted spectroscopy. The ion beam produced in a volume H^- source contains O^-, OH^-, and O_2^- ions, whose contents are less than 1%. The O^- impurity increases with plasma density because of an enhancement of dissociation of OH^-. Although the momentum mass analyzer was scanned up to M=200, no metal impurity was found. (author).

4427 (JAERI-M–89-167) **Polarized proton scattering on lithium isotopes at 14 MeV.** Koori, Norihiko; Kumabe, Isao; Hyakutake, Mikio; Orito, Kouichi; Akagi, Katsumi; Iida, Akihide; Watanabe, Yukinobu; Sagara, Kenshi; Nakamura, Hiroyuki; Maeda, Kazuhide; Nakashima, Takao; Kamimura, Masayasu; Sakuragi, Yukinori. Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment. c Nov 1989. 38p. Sponsored by Japan Atomic Energy Research Institute. (NEANDC(J)–143/U;INDC(JPN)–130/L). Available from Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan.

Differential cross sections, analyzing powers, and double differential cross sections for the ^{6,7}Li (p,p′) scattering have been measured at an incident energy of 14 MeV. Experimental procedures and results are briefly described. The experimental data of the elastic scattering have excellently been reproduced by calculations based on the spherical optical model (SOM) and the coupled channel (CC) method. The DWBA and CC calculations have not correctly predicted the analyzing powers in the inelastic channels leading to the 1st and 2nd excited states of ^{6,7}Li. The three-body breakup process observed in the (p,p′) continuum spectra has been qualitatively explained by DWBA calculations with the discretized-continuum states. The experimental and theoretical results are compared with neutron scattering data. Studies on proton scattering are valuable for modelling of nuclear reactions and for evaluation of neutron scatterings. 17 refs., 10 figs., 3 tabs.

4428 (LA-UR–89-1909) **Performance of the 10kV, 100-kA pulsed-power modules for the FRX-C magnetic compression experiment.** Rej, D.J.; Waganaar, W.J. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890665–31: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89014027. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper, we present detailed performance data collected from over a year's operation of the 25 and 50-kJoule pulsed-power capacitor-bank modules developed for the Los Alamos magnetic fusion facility FRX-C. These modules supply the 5-MA magnet current needed for the compressional heating of compact toroid plasmoids. To date, 54 modules have been built and successfully tested at their full design rating: 100-kA peak output current at 10-kV charge, $\tau_{1/4}$ = 60 μs (25-kJ module), or 110 μs (50-kJ module), crowbar L/R $\leq$ 1 ms. Modules are compact, cost about $5000 each, and though designed for 25 or 50 kJ, they can be easily modified for other pulsed-power applications. Energy is stored in 25-kJ capacitors. Start and crowbar switching is performed with a pair of water-cooled, size-D ignitrons. As an alternative to an ignitron, crowbar switching by solid-state rectifiers has been successfully demonstrated. Current is conducted between components and to the load by parallel-plate transmission lines and by a parallel array of commercially-available coaxial cable. 4 refs., 8 figs.

4429 (LA-UR–89-3068) **Calculation of the production cross sections of high-spin isomeric states in hafnium.** Chadwick, M.B.; Young, P.G. Los Alamos National Lab., NM (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research; U.K. Atomic Energy Authority. DOE Contract W-7405-ENG-36. (CONF-890982–6: International meeting on neutron activation cross sections for fission and fusion energy applications, Argonne, IL (USA), 11-15 Sep 1989). Order Number DE90001836. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The $J^\pi = 16^+$ isomeric state in ^{178}Hf(E_x = 2.447 MeV), which has a halflife of 31 years, poses a threat for serious radioactive activation problems in some fusion reactor designs if its production in 14-MeV neutron reactions is significant. The relatively high excitation energy (2.447 MeV) of this state results in it lying in the continuum region, so it is necessary in a calculation to reconstruct the salient nuclear structure around the state, particularly rotational band levels that might be populated and would feed into it. Using preequilibrium and Hauser-Feshbach statistical theories, the cross sections for this and other hafnium isomeric states are calculated and compared with experimental measurements, where available. 13 refs., 6 figs., 3 tabs.

4430 (LA-UR–89-3268) **A high-speed beam of lithium droplets for collecting diverted energy and particles in ITER [International Thermonuclear Experimental Reactor].** Werley, K.A. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–53: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002354. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A high-speed (160m/s) beam (0.14 x 0.86m) of liquid-lithium droplets passing through the divertor region(s) below (and above) the main plasma has the potential to replace and out-perform "conventional" solid divertor plates in both heat and particle removal. In addition to superior heat-collection properties, the lithium beam would: remove impurities; require low power to circulate the lithium; exhibit low-recycle divertor operation compatible with lower-hybrid current drive, H-mode plasma confinement, and no flow reversal in the edge plasma; be insensitive to plasma shifts; and finally protect solid structures from the plasma thermal energy for those disruptions that deposit energy preferentially into the divertor while simultaneously being rapidly re-established after a major disruption. Scoping

calculations identifying the beam configuration and the droplet dynamics, including formation, MHD effects, gravitational effects, thermal response and hydrodynamics, are presented. Limitations and uncertainties are also discussed. 20 refs., 6 figs., 3 tabs.

4431 (LA-UR–89-3275) **Quality assurance and quality control for the compact physics research facility (CPRF) and ZTH experiment.** Kewish, R.W. Jr. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–56: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002352. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In compliance with DOE Order 5700.6B, which establishes policies to assure quality achievement in DOE programs, we instituted a quality assurance and quality control program whose primary goal is to assure that reliable components are available with which to assemble the CPRF/ZTH experiment. The Code of Federal Regulations 10 CFR 50, appendix B, and the ANSI standard N45.2 were used as a primary source of guidance in establishing a plan for our QA program. Accepted codes, such as the National Electric Code (NEC), and standards adopted by organizations such as ANSI, IEEE, ASME, and NEMA were used in the design and production of components in keeping with the primary goal of the CPRF program. In setting up the CPRF/ZTH quality assurance program it was our intention to have these standards apply to all suppliers, both within and outside the Laboratory. 5 refs., 6 figs.

4432 (LA-UR–89-3277) **A cost effective battery bank for I^2t testing and evaluation of electrical switchgear.** Reass, W.A. Los Alamos National Lab., NM (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–58: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002350. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper describes the electrical design and mechanical construction of a 50 kA "step switched" battery bank. Individual fuses protect each of the forty parallel isolated strings of three series (12 V) batteries. Step current waveforms of 12.5 kA, 25 kA, 37.5 kA, and 50 kA are produced by 8 sets of pneumatically driven 20 pole step switches and current limiting stainless steel "trombone" resistors. Inexpensive, yet conservatively designed, Group 65 Motorcraft car batteries are used to give an I^2t capability of better than 5×10^9. The battery bank has well over 1500 shots, with testing of commercial switchgear continuing. In addition to the battery bank engineering data, results of repetitive testing of vacuum interrupters at their I^2t limit will be provided. 8 figs.

4433 (LA-UR–89-3289) **Fiber optic control and diagnostic family of hardwares for the Confinement Physics Research Facility (CPRF) toroidal field and dc interrupter systems.** Reass, W.A.; Schrank, L.S. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–48: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002345. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A versatile fiber optic system of outstanding performance has been designed and utilized in the development of the CPRF pulsed power equipment. These fiber optic systems consist of a family of interchangeable, but application oriented, mother and daughter PC boards. Furthermore, a self contained, chassis, or "CAMAC" format of links are available. The transmitter family may be described as having a true instrumentation amplifier front end (of unique design), a temperature compensated V/F converter, and fiber optic and differential current loop outputs. The receiver family consists of various mother and daughter boards which can easily be interchanged to optimize overall system requirements. The receivers are temperature compensated and capable of driving 50Ω loads to full output. Receivers boast a better than 67 dB S+N/N ratio without any noticeable overshoot or ringing. A no input "shutdown" and a "remote flag" feature is used to protect sensitive or control hardware. The overall link performance can be typified by having a bipolar "pick & mix" accuracy of better than .5% from all causes; offset, drift, nonlinearity, and thd. Hand-picked pairs easily achieve better than .2% bipolar accuracy. A unipolar circuit can easily be set to "0" error, with less than .5 mV/°C offset. Presented will be the detailed design information along with examples of application specific hardware. 11 figs., 1 tab.

4434 (LA-UR–89-3292) **Transportation of a 451 ton generator stator and a 234 ton generator rotor from Hartsville, TN, to Los Alamos, NM.** Boenig, H.J.; Rogers, J.D.; McLelland, G.R.; Pelts, C.T. Los Alamos National Lab., NM (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–71: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002447. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A 1430 MVA steam turbine generator was acquired from a cancelled nuclear power plant in Tennessee to be used as the pulsed power and energy storage unit for the Confinement Physics Research Facility being built at Los Alamos, NM. The transportation from Hartsville, near Nashville, TN, to Los Alamos, NM, of the two largest single pieces of the generator, a 451 t stator and a 234 t rotor presented a special challenge. Details of the move, by barge from Hartsville to Catoosa, near Tulsa, OK, by rail from Catoosa to Lamy, near Santa Fe, NM, and by road from Lamy to Los Alamos are described. The greatest difficulty of the successful move was the crossing of the Rio Grande river on an existing reinforced concrete bridge. The two-lane wide road transporters for the stator and rotor were fitted with outriggers to provide a four-lane wide vehicle, thus spreading the load over the entire bridge width and meeting acceptable load distribution and bridge safety factors. 2 refs., 6 figs.

4435 (LA-UR–89-3297) **Optimization of the testing volumes with respect to neutron flux levels in the two-target high flux D-Li neutron source for the international fusion materials irradiation facility.** Kelleher, W.P.; Varsamis, G.L. Los Alamos National Lab., NM (USA). [1989]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–69: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002445. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An economic and fusion-relevant source of high-energy neutrons is an essential element in the fusion nuclear technology and development program. This source can be generated by directing a high energy deuteron beam onto a flowing liquid lithium target, producing neutrons via the D-Lithium stripping reaction. Previous work on this type of source concentrated on a design employing one deuteron beam of modest amperage. This design was shown to have a relatively small testing volume with high flux gradients and was therefor considered somewhat unattractive from a materials testing standpoint. A design using two lithium targets and two high-amperage beams has recently been proposed. This two beam design has been examined in an effort to maximize the test volume while minimizing the flux gradients and minimizing the effect of radiation damage on one target due to the other. A spatial, energy and angle dependent neutron source modeling the D-Lithium source was developed. Using this source, a 3-dimensional map of uncollided flux within the test volume was calculated. The results showed that the target separation has little effect on the available experimental volume and that a testing volume of ~35 liters is available with a volume averaged flux above 10^{14} n/cm^2/s. The collided flux within the test volume was then determined by coupling the source model with a Monte Carlo code. The spectral effects of the high-energy tail in the flux were examined and evaluated as to possible effects on materials response. Calculations comparing the radiation damage to materials from the D-Lithium source to that cause by a standard DT fusion first-wall neutron flux spectrum showed that the number of appm and dpa, as well as the ratio appm/dpa and dpa/MW/m^2 are within 30% for the two sources. 8 refs., 8 figs.

4436 (LA-UR–89-3342) **Testing of a 50 kA, 50 kV current interrupter with I^2t preheating and long recovery voltage.** Reass, W.A.; Boenig, H.J.; Melton, J.G. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891007–76: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002436. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Confinement Physics Research Facility (CPRF) presently being constructed at Los Alamos in a next generation Reversed Field Pinch (RFP) plasma experiment. An inductive energy transfer system, employing a 50 kA, 50 kV dc current interrupter, is being utilized for initiating the plasma current. These performance requirements (50 kA, 50 kV) had yet to be realized in a reliable switching system, development of this current interrupter system was initiated. A switch test bay with a 50 kA battery bank has been built at Los Alamos to test the interrupter in conditions which will exist in the CPRF experiment. Many switch parameters were measured to provide information on the current interrupting characteristics and reliability. Some of these diagnostics include voltage, current, pre and post I^2t contact resistance, opening speed and position, arc voltage, and stem temperature. To determine any long term changes, all shots and data channels are computer indexed, and may be easily recalled for review. Extensive testing was performed on Siemens D-10 vacuum interrupter. Test parameter space included 55 kA, 40 kV (per bottle); di/dt of 2250 A/μs, I^2t of 5 x 10^9 amp^2 sec; and 20 kV-200 msec RC recovery decay. Circuit parameters effect opening reliability. Circuit data and the associated testing results will be presented along with long term trends of switch performance under "normal" conditions. 12 figs.

4437 (LA-UR–89-3407) **Design and performance of future KrF laser-fusion facilities.** Harris, D.B.; Sullivan, J.A.; Coggeshall, S.V. Los Alamos National Lab., NM (USA). [1989]. 35p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891007–64: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002385. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US inertial confinement fusion program is investigating the feasibility of constructing a high-gain Laboratory Microfusion Facility (LMF). Considerable uncertainties and risks exist for all of the driver candidates in proceeding directly to this facility without an intermediate step. These risks fall into the categories of driver performance and cost, target physics, and target chamber performance. Los Alamos has developed a plan to resolve these issues before construction of the LMF. The plan calls for the construction of an LMF prototype beamline at the 100-kJ energy level and the parallel development of a large (240 kJ) KrF amplifier module. The prototype facility, called the Laser Target Facility (LTTF), will address target physics issues at the 100-kJ level and will demonstrate the performance and cost scaling of KrF lasers. In parallel with this construction, a 240-kJ LMF amplifier module will also be developed. After successful operation of the LTTF for a period of about two years and construction and operation of the LMF amplifier module, all driver issues will be satisfactorily resolved. If sufficient understanding of target physics extrapolations is realized from this facility, the LMF can then be constructed with acceptable risk. If an additional step is needed for understanding target physics and capsule ignition, the LTTF can be upgraded to an energy level on target of 1-3 MJ. This upgrade would provide a direct test of LMF scale laser and optic hardware and would provide much information on the function of the LMF target chamber. The construction of a 3-MJ KrF facility could be an LMF if high target gains are achieved with shaped, broadband KrF laser pulses. 3 figs.

4438 (LBL–27230) **Heavy Ion Fusion Accelerator Research (HIFAR) half-year report, October 1, 1988–March 31, 1989.** Lawrence Berkeley Lab., CA (USA). Jun 1989. 46p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (HIFAN–431). Order Number DE90003296. Available from NTIS, PC A03/MF A01; OSTI; INIS.

The basic objective of the Heavy Ion Fusion Accelerator Research (HIFAR) program is to assess the suitability of heavy ion accelerators as igniters for Inertial Confinement Fusion (ICF). A specific accelerator technology, the induction linac, has been studied at the Lawrence Berkeley Laboratory and has reached the point at which its viability for ICF applications can be assessed over the next few years. The HIFAR program addresses the generation of high-power, high-brightness beams of heavy ions, the understanding of the scaling laws in this novel physics regime, and the validation of new accelerator strategies, to cut costs. Key elements to be addressed include: beam quality limits set by transverse and longitudinal beam physics; development of induction accelerating modules, and multiple-beam hardware, at affordable costs; acceleration of multiple beams with current amplification –both new features in a linac – without significant dilution of the optical quality of the beams; and final bunching, transport, and accurate focusing on a small target.

4439 (LBL–27743) **Comparison of H^{minus} and D^{minus} production in a magnetically filtered multicusp source.** Inoue, T.; Ackerman, G.D.; Cooper, W.S.; Hanada, M.; Kwan, J.W.; Ohara, Y.; Okumura, Y.; Seki, M. Lawrence Berkeley Lab., CA (USA). Apr 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890703–22: International conference on ion sources, Berkeley, CA (USA), 10-14 Jul 1989). Order Number DE90002450. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A JAERI negative ion source was tested at LBL as part of the US-Japan Fusion Cooperation Program. By varying the strength of magnetic filter from 450 to 930 Gauss-cm, we compared production, transport, and extraction of the negative ions. The maximum current densities, which obtained at the corresponding optimum filter strength for each gas species, were 10.4 mA/cm^2 for H^- and 8.4 mA/cm^2 for D^- at arc discharges of 40 kW. The ratio of the ion current densities (J_{D^-}/J_{H^-}) is about 0.8, which is higher than $1/\sqrt{2}$. The electron to negative ion ration was 13 for hydrogen and 38 for deuterium at the corresponding optimum filter strength. The higher ratio in deuterium is probably due to higher space potential of deuterium plasma by a few volts. 9 refs., 7 figs.

4440 (PPLK–10) **Proceedings of US-Japan workshop on new generation experiments and reactors (joined by EC).** Kyoto Univ., Uji (Japan). Plasma Physics Lab. Jul 1988. 250p. (CONF-880794–: U.S.-Japan/IEA workshop on next-generation experiments and reactors, Kyoto (Japan), 25-28 Jul 1988). Order Number DE90719713. Available from NTIS (US Sales Only), PC A11/MF A01.

The workshop, titled 'New Generation Experiments and Reactors', was held at Plasma Physics Laboratory, Kyoto University from 25 to 28 July 1988. The purpose of the meeting was to review the latest achievements and status of stellarator/heliotron new generation experiments as well as the prospects for stellarator/heliotron fusion reactors on the occasion when the New Large Helical System of MOE in Japan is being realized. The reports on the New Large Helical System of MOE cover an overview, physics issues, design, MHD studies, transport code results and bootstrap current, particle orbit studies, divertor studies, NBI heating, analysis of wave heating, heating system, diagnostics, and SC coil technology. The reports on ATF II cover an overview, physics studies strategy, status of physics studies, engineering issues, perspective of helical systems, issues for next-generation experiments and relationship to the Univ. of Wisconsin Program, and issues for next-generation experiments and relation to Auburn Program. Other reports address recent studies of present devices, studies related with WVIIX, and reactor studies. (N.K.).

4441 (PPLK-R–28) **Biased limiter experiment in the Heliotron E device.** Motojima, O.; Harada, M.; Takeiri, Y. and others. Kyoto Univ., Uji (Japan). Plasma Physics Lab. Aug 1988. 21p. Order Number DE90719522. Available from NTIS (US Sales Only), PC A03/MF A01.

The first biased limiter experiment has been done in Heliotron E, which is a typical stellarator/heliotron type device. This experiment investigates the boundary physics of the currentless plasmas, which are produced in the magnetic limiter (divertor) configuration. We analyze the experimental results related to the surface potential, recycling process, and plasma parameters using a material limiter which was biased from the vacuum chamber. The boundary density profile was measured by a thermal Li beam probe to investigate the effect of the biased limiter. (author).

4442 (UCID–21810) **NTES [Nuclear Test and Experimental Sciences Program] laser facility for physics experiments Building 391 High Bay Option.** Christie, D.J.; Foley, R.J.; Frank, D.N.; Henesian, M.A.; Hermes, G.L.; Hunt, J.T.; Labiak, W.G.; Larson, D.W.; Lawson, J.K.; Mayo, S.E.; Patton, H.G.; Perry, M.D.; Richards, J.B.; Swain, J.E.; Swift, D.C.; Tietbohl, G.L.; Van Arsdall, P.J.; Wallerstein, ELawrence Livermore National Lab., CA (USA).

31 Aug 1989. 47p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90001795. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report discusses the following topics: high-energy laser driver; NTES laser and experiment facilities; system control and data acquisition; and auxiliary lasers.

4443 (UCLA/PPG–1135) **The TITAN Reversed-Field Pinch fusion reactor study: Collection of papers.** California Univ., Los Angeles, CA (USA); GA Technologies, Inc., San Diego, CA (USA); Los Alamos National Lab., NM (USA); Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Nuclear Engineering and Engineering Physics. Mar 1988. 174p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-86ER52126. (CONF-880417–Pt.2: 1. international symposium on nuclear fusion technology (ISFNT), Tokyo (Japan), 10-19 Apr 1988). Order Number DE90001808. Available from NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

The TITAN Reversed-Field Pinch (RFP) fusion reactor study is a multi-institutional research effort to determine the technical feasibility and key developmental issues of an RFP fusion reactor, especially at high power density, and to determine the potential economics, operations, safety, and environmental features of high-mass-power-density fusion systems. The TITAN conceptual designs are DT burning, 1000 MWe power reactors based on the RFP confinement concept. The designs are compact, have a high neutron wall loading of 18 MW/m^2 and a mass power density of 700 kWe/tonne. The inherent characteristics of the RFP confinement concept make fusion reactors with such a high mass power density possible. Two different detailed designs have emerged: the TITAN-I lithium-vanadium design, incorporating the integrated-blanket-coil concept; and the TITAN-II aqueous loop-in-pool design with ferritic steel structure. This report contains a collection of 16 papers on the results of the TITAN study which were presented at the International Symposium on Fusion Nuclear Technology. This collection describes the TITAN research effort, and specifically the TITAN-I and TITAN-II designs, summarizing the major results, the key technical issues, and the central conclusions and recommendations. Overall, the basic conclusions are that high-mass power-density fusion reactors appear to be technically feasible even with neutron wall loadings up to 20 MW/m^2; that single-piece maintenance of the FPC is possible and advantageous; that the economics of the reactor is enhanced by its compactness; and the safety and environmental features need not to be sacrificed in high-power-density designs. The fact that two design approaches have emerged, and others may also be possible, in some sense indicates the robustness of the general findings.

4444 (UCRL–98191) **Advanced fusion MHD power conversion using the CFAR [compact fusion advanced Rankine] cycle concept.** Hoffman, M.A.; Campbell, R.; Logan, B.G. Lawrence Livermore National Lab., CA (USA). Oct 1988. 15p. Sponsored by U.S. DOE Energy Research. (CONF-881031–76: 8. topical meeting on technology of fusion energy, Salt Lake City, UT (USA), 9-13 Oct 1988). Order Number DE90003014. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The CFAR (compact fusion advanced Rankine) cycle concept for a tokamak reactor involves the use of a high-temperature Rankine cycle in combination with microwave superheaters and nonequilibrium MHD disk generators to obtain a compact, low-capital-cost power conversion system which fits almost entirely within the reactor vault. The significant savings in the balance-of-plant costs are expected to result in much lower costs of electricity than previous concepts. This paper describes the unique features of the CFAR cycle and a high- temperature blanket designed to take advantage of it as well as the predicted performance of the MHD disk generators using mercury seeded with cesium. 40 refs., 8 figs., 3 tabs.

4445 (UCRL–100432) **Design of a high-gain flux-compression generator.** Pincosy, P.A.; Abe, D.K.; Chase, J.B. Lawrence Livermore National Lab., CA (USA). 1 Sep 1989. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890710–22: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989). Order Number DE90002795. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The current gain of a high-gain, high-explosive helical magnetic-flux-compression generator (HEG) is limited both by nonuniformities in stator expansion and by armature-stator misalignment. We set out to achieve three goals: first, an output current of at least 2 MA with a current gain greater than 1000 to drive a 150- to 300-nH load; second, a generator with an acceptably small volume and length; and finally, generator output of a reliable magnitude. 5 refs., 6 figs.

4446 (UCRL–100533) **Design and fabrication of the CPQ [Conductor Performance Qualification] coil.** Shen, S.S.; Patrick, R.E.; Miller, J.R.; Chaplin, M.R.; Heim, J.R.; Kerns, J.A.; Slack, D.S.; Summers, L.T. Lawrence Livermore National Lab., CA (USA). 24 Aug 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890850–4: 11. international conference on magnet technology, Tsukuba (Japan), 28 Aug - 1 sep 1989). Order Number DE90002821. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The design and fabrication process of a 15-T, 4000-A, Nb_3Sn test coil are described. In the Conductor Performance Qualification (CPQ) coil, it is intended to demonstrate the reliable performance of cable-in-conduit conductors (CICC) produced in large quantities from internal-tin process, multifilamentary, Nb_3Sn composites. In addition, techniques appropriate for the insulate-wind-react-impregnate method of coil construction using CICCs, such as joints and insulations are developed and demonstrated. The coil is designed to operate at a maximum field of 15 T as an insert to the High-Field Test Facility Solenoid at LLNL. It consists of four grades of CICCs, each made of the same number, but a different size, of composite wires. Operating current density over the first-grade conductor winding is 40 $A{\cdot}mm^{-2}$ at 15 T. Also presented is a novel ripple heating scheme to inject heat at specific levels appropriate for a close simulation of ac and nuclear heat loads in a fusion reactor. Up to 100 W of heating power can be simulated within the coil winding, allowing the effects of such heating on the coil performance to be investigated. 5 refs., 7 figs., 2 tabs.

4447 (UCRL–101113) **Neutronics issues for starlight: An inertial confinement fusion reactor concept.** Tobin, M.T. Lawrence Livermore National Lab., CA (USA). 30 Sep 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891007–79: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002790. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Features of the STARLIGHT reactor concept may represent significant improvements in ICF reactor design. The reactor will allow an arbitrary illumination geometry for the reactor driver, the reactor will have few moving parts, and the use of a shield integrated with the ICF target assembly will extend the bare first wall lifetime otherwise limited by the wall ablation caused by x rays and target debris. Here we discuss an evolving design by reporting results of 1- and 2-D calculations involving tritium breeding, neutron damage, and the beam port neutron leakage. We conclude that an ICF reactor using a solid breeder is feasible. A "low-temperature" option is the use of a steel first wall and Li_2O as the breeding material. This first wall has an expected lifetime of more than six years. Further, up to 10 cm thickness can be tolerated before the tritium breeding ratio falls below unity. We are unaware of a suitable high temperature first wall material for a "high-temperature" option. This option would use a ceramic first wall and breed tritium in $LiAlO_2$, allowing all the reactor components to operate a high temperatures that allow efficient use of He as a coolant. Of the ceramics examined, SiC appears to be the best choice for considering both tritium breeding and wall lifetime. However, He production will limit that lifetime to five months, clearly not an economical lifetime. Further, Li_2O is necessary rather than $LiAlO_2$ (at 7 cm wall thickness) to achieve a favorable tritium breeding ratio with SiC. Here, the benefits of using ceramics are lost as Li_2O has a much lower melting point than $LiAlO_2$. 12 refs., 3 figs., 1 tab.

4448 (UCRL–101145) **Wall ablation, gas dynamics, and the history of wall stresses in ICF target chambers.** Orth, C.D. Lawrence Livermore National Lab., CA (USA). 30 Sep 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891007–80: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002789. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We calculate the history of wall stresses for spherical aluminum LMF-type ICF target chambers 10 cm thick with 1400-MJ pellets using a simple computer program called CHAMBER that incorporates the physics of first-wall ablation and chamber gas dynamics, including dissociation, ionization, and gas reverberations. By considering the time dependence of the wall stresses, we calculate peak stresses that are higher or lower than previous estimates based on the dynamic formula $\sigma_{dyn} \approx Pr/\Delta R$, depending on the radius of the chamber. Here P is the interior pressure, R is the chamber radius, and ΔR is the wall thickness. In particular, the previous estimates are too small for chambers with radii $R > 4$ m or $R < 0.5$ m, because the ablation impulse dominates the stress for $R > 4$ m, and the post-ablation pressure impulse dominates for $R < 0.5$ cm. CHAMER also shows that considerably more wall mass can be ablated after the x-ray-vaporized mass fills the chamber if the thermalized vapor radiates more energy to the wall than the wall can conduct away by heat condition, as in small chambers. Venting of a chamber can reduce the wall stress only to that caused by the ablation impulse, and only for vents with radii comparable to the radius of the chamber. 1 ref., 2 figs.

4449 (UCRL–101148) **Laboratory microfusion facility – Neutronics and radiological safety analysis.** Tobin, M.T.; Singh, M.S.; Meier, W.R. Lawrence Livermore National Lab., CA (USA). 30 Sep 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891007–81: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002787. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary goal of the Laboratory Microfusion Facility (LMF) is to conduct some 1400 target experiments over a five-year period to demonstrate high gain in the laboratory. Projected yields for these experiments range from < 10 MJ to 1000 MJ. High gain experiments are expected to be conducted once per week. After high gain has been achieved, target yields above 100 MJ will be used to conduct weapons physics and weapons effects experiments. In addition, experiments will be conducted to assess the viability of inertial fusion of electric power production space propulsion and space power. This will extend the facility lifetime to as much as 30 years. We have set two design goals that minimize effect of radiation hazards on the operation of the facility. The first is that LMF workers will have access to the diagnostic platforms outside the target chamber within 24 hours after a high-yield shot. This is necessary for retrieving data and preparing for the next experiment. Although it is plausible that routine interior chamber operations may be done remotely, workers may occasionally require access to the inside of the chamber for special tasks. Therefore, the second design goal is that workers can safely enter the chamber for a short time 7 days after a high-yield experiment. We have previously reported many aspects of radiological safety concerning the LME. Here we report further work covering beam tube activation, final optics activation, neutron heating of a diagnostic, electromagnetic pulse (EMP) generation, radiation shielding and tritium recovery/disposal issues. 13 refs., 3 figs., 2 tabs.

4450 (UCRL–101481) **Practical aspects of a 2-D edge-plasma model.** Rensink, M.E.; Hill, D.N.; Porter, G.D.; Braams, B.J. Lawrence Livermore National Lab., CA (USA). Jul 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-890931–9: 13. conference on the numerical simulation of plasmas, Santa Fe, NM (USA), 17-20 Sep 1989). Order Number DE90002995. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The poloidal divertor configuration is considered the most promising solution to the particle and energy exhaust problem for a tokamak reactor. The scrape-off layer plasma surrounding the core and the high-recycling plasma near the divertor plates can be modelled by fluid equations for particle, momentum and energy transport. A numerical code (B2) based on a two-dimensional multifluid model has been developed for the study of edge plasmas in tokamaks. In this report we identify some key features of this model as applied to the DIII-D tokamak. 2 refs., 1 fig.

4451 (UCRL–101649) **SBS [stimulated Brillouin scattering] pulse distortion in multimode optical fibers: Preliminary results.** Smith, J.R.; Hawkins, R.J.; Laumann, C.W.; Hatch, J. Lawrence Livermore National Lab., CA (USA). [1989]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890836–18: 33. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering, San Diego, CA (USA), 6-11 Aug 1989). Order Number DE90003023. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

We have observed sever temporal-pulse-shape distortion due to stimulated Brillouin scattering (SBS) in multimode optical fibers used to diagnose 351 m laser pulses on the Nova laser system. Our measurements can be fit by a basic model of SBS and provide a clear indication of the intensity and temporal regimes where significant SBS-induced temporal-pulse-shape distortion can be avoided. 15 refs., 3 figs., 1 tab.

4452 (UCRL–101756) **ITER [International Thermonuclear Experimental Reactor] in perspective.** Henning, C.D. Lawrence Livermore National Lab., CA (USA). 20 Oct 1989. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-48. (CONF-891007–82: 13. international symposium on fusion engineering, Knoxville, TN (USA), 2-6 Oct 1989). Order Number DE90002819. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The International Thermonuclear Experimental Reactor (ITER) team is completing the second year of a three-year conceptual design phase. The purpose of ITER is to demonstrate the scientific and technological feasibility of fusion power. It is to demonstrate plasma ignition and extended burn with steady state as the ultimate goal. In so doing, it is to provide the physics data base needed for a demonstration tokamak power reactor and to demonstrate reactor-relevant technologies, such as high-heat-flux and nuclear components for fusion power. To meet these objectives, many design compromises had to be reached by the participants following a careful review of the physics and technology base for fusion. The current ITER design features a 6-m major radius, a 2.15-m minor radius and a 22-MA plasma current. About 330 volt-seconds in the poloidal field system inductively drive the current for hundreds of seconds. Moreover, about 125 MW of neutral-beam, lower-hybrid, and electron-cyclotron power are provided for steady-state current drive and heating all these systems are discussed in this paper. 3 refs., 6 figs., 7 tabs.

4453 **Kilojoule operation of the Aurora KrF ICF laser system at Los Alamos.** Rosocha, L.A. (Los Alamos National Lab., NM (USA)); Anderson, R.G.; Czuchlewski, S.J.; Hanlon, J.A.; Jones, J.E.; Jones, R.G.; Kang, M.; Kristal, R.; Mansfield, C.R.; Thomas, S.J. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper MG2.

The Los Alamos Aurora laser system, which is a prototype for developing high power short wavelength drivers for inertial confinement fusion (ICF), has passed through the final phases of construction and system integration. The Aurora system is layout is shown in this paper. The authors discuss the completion of the system integration process (including the final laser power amplifier) and progress in the delivery of near-kilojoule energy level pulses to the demultiplexer and target chamber. Integrated amplifier chain performance, measurement of the extracted beam energy, and issues related to beam transport to the target are emphasized.

4454 **Effects of laser beam smoothing on laser-plasma interaction.** Obenschain, S.P. (U.S. Naval Research Lab., Washington, DC (US)). pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper MG1.

The gain inertial fusion requires highly uniform pellet implosions. For directly illuminated pellets the individual beams that illuminate the pellet must have highly uniform and controlled focal profiles. The authors discuss the technology, advantages, and limitations of adding controlled amounts of spatial incoherence in the laser to obtain this uniform illumination. The main portion of this paper deals with improvements in high intensity laser-plasma interaction physics

observed when using beams smoothed by spatial incoherence. Two means for beam smoothing have been developed and are discussed here. The mechanisms by which spatial incoherence is suppressing deleterious instabilities and the implications this has on the beam smoothing technolgy for laser fusion is discussed.

4455 **Crossed-field amplifiers as RF drivers for particle beam accelerators.** Dionne, N. (Raytheon Co., Microwave and Power Tube Div., Waltham, MA (US)); Edwards, R.; Mallavarpu, R. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2C3.

A class of crossed-field amplifier in which the microwave signal is injected onto a circuit integral with the cathode of the tube offers several advantages as an rf driver for particle-beam accelerators. An investigation is in progress to determine the basic capability of an existing S-band, cathode-driven CFA for operating into a resonant cavity load as would be found in a LINAC. In this paper stability issues such as device operation into high VSWR loads are discussed. Relevant tube characteristics (amplitude, phase and frequency stability) are treated with regard to optimization. Features of the CFA driver such as quick turn-on startability are given detailed attention.

4456 **Radiation of a finite electron-beam pulse in a free-electron laser amplifier.** Hafizi, B. (Plasma Theory Branch, Plasma Physics Div., Naval Research Lab., Washington, DC (US)); Ting, A.; Sprangle, P.; Tang, C.M. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2P41.

The development of an electron beam propagating through a wiggler is of interest in a number of applications. The authors have developed a time-dependent code to study the motion of an electron beam of finite axial extent through a planar wiggler. It is discussed here. This paper presents results for both tapered and untapered wigglers, and examines, in detail, the distortion of the electron-beam pulse as it propagates through the wiggler.

4457 **OHMIC ignition in a single-turn-coil Tokamak (IGNITEX).** Montalvo, E. (The Univ. of Texas, Austin, TX (USA)); Carrera, R.; Ordonez, C.; Rosenbluth, M.N. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A study of the basic plasma physics characteristics of the recently proposed fusion ignition experiment (IGNITEX) is presented in this paper. During the early stages of the discharge a D-T plasma is heated up chemically; anomalous transport losses are well described by the neoalcator scaling. Later in the discharge when alpha heating becomes significant, confinement is assumed to be degraded by the total power produced in the plasma (ohmic plus alpha heating). Bremsstrahlung is the initially dominant radiation loss. However, once ignition conditions are reached, cyclotron radiation emission becomes dominant. The IGNITEX design proposes an optimum compromise between plasma physics and engineering considerations and then it provides a high ignition margin in the L mode of operation. Control of the thermal instability during the ignited phase of the discharge is possible. In the IGNITEX concept uncertainties are minimized by maintaining the plasma discharge far from marginal stability and by maximizing alpha confinement predictions. In addition, IGNITEX is designed to produce ignition without need for neither auxiliary heating nor H mode of operation.

4458 **Operating large controlled thermonuclear fusion research facilities.** Gaudreau, M.P.J. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, MA (USA)); Tarrh, J.M.; Post, R.S.; Thomas, P. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The MIT Tara Tandem Mirror is a large, state of the art controlled thermonuclear fusion research facility. Over the six years of its design, implementation, and operation, every effort was made to minimize cost and maximize performance by using the best and latest hardware, software, and scientific and operational techniques. After reviewing all major DOE fusion facilities, an independent DOE review committee concluded that the Tara operation was the most automated and efficient of all DOE facilities. This paper includes a review of the key elements of the Tara design, construction, operation, management, physics milestones, and funding that led to this success. The authors emphasize a chronological description of how the system evolved from the proposal stage to a mature device with an emphasis on the basic philosophies behind the implementation process. This description can serve both as a qualitative and quantitative database for future large experiment planning. It includes actual final costs and manpower spent as well as actual run and maintenance schedules, number of data shots, major system failures, etc. The paper concludes with recommendations for the next generation of facilities.

4459 **Architecture of the ETR systems code.** Reid, R.L. (Fusion Engineering Design Center, Oak Ridge National Lab., PO Box Y, Oak Ridge, TN 37831 (USA)); Galambos, J.D. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

TETRA, a tokamak systems code capable of modeling experimental test reactors (ETRs), was developed in a joint effort by participants of the fusion community. The first version of this code was constructed to model devices similar to the Tokamak Ignition/Burn Engineering Reactor (TIBER) in configuration and design. A major feature of this code is its ability to perform optimization studies. Future work will include broadening the scope of the code, particularly in the area of materials selection, to more accurately simulate tokamak configurations such as the Next European Torus (NET) and the Fusion Engineering Reactor (FER).

4460 **CPRF/ZTH shell poloidal gap design and fabrication.** Yavornik, E.J. (Los Alamos National Lab., PO Box 1663, Los Alamos, NM 87545 (USA)); Moses, R.W.; Dransfield, G.D.; Custer, D.M. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Design is in progress on a new generation Reversed Field Pinch (RFP) machine, designated as ZTH, to be assembled at Los Alamos National Laboratory during FY 86-92. The front end of the machine will consist of an external electrically conducting shell that supports an internal vacuum liner containing the plasma. The external shell will contain insulated toroidal and poloidal gaps to permit penetration of magnetic fields and voltage to the plasma. Many perturbations of the magnetic field induce toroidal shell currents with poloidal Fourier components having mode numbers $m \geq 1$. A typical butt-joint poloidal gap will convert these image currents into potentially damaging magnetic field errors with a large spectrum of toroidal-mode numbers. The ZTH shell poloidal gap will use concentric overlapping tapered shells in its construction, which will serve to minimize these errors.

4461 **Design studies of the APEX light ion fusion experiment.** Moses, G.A. (Univ. of Wisconsin-Madison, 1500 Johnson Drive, Madison, WI 53706 (USA)); Engelstad, R.L.; Lovell, E.G.; Peterson, R.R.; Whitley, R.; Connelly, M.; Glasgow, B.; Patel, A.; Yamamoto, R.; Callen, J. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The APEX project is an upgrade of the PBFA-II light ion fusion accelerator at Sandia Laboratories, Albuquerque to allow pulse shaping for driving high gain ICF targets. This upgrade includes: modification of the pulsed power, replacement of the barrel diode with an extraction diode, addition of a z-pinch plasma channel, and addition of a shielded target chamber. In this paper the authors emphasize the structural response of the target chamber to a 100 MJ light ion driven target microexplosion, shielding and containment of

the induced radioactivity, and modification of the PBFA-II facility to accommodate the APEX chamber.

4462 Economic comparison of fusion fuel cycles. Brereton, S.J. (Massachusetts Institute of Technology, Cambridge, MA 02139 (USA)); Kazimi, M.S. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The economics of the DT, DD, and DHe fusion fuel cycles are evaluated by comparison on a consistent basis. The designs for the comparison employ HT-9 structure and helium coolant; liquid lithium is used as the tritium breeding material for the DT fuel cycle. The reactors are pulsed, superconducting tokamaks, producing 1200 MW of electric power. The DT and DD designs scan a range of values of plasma beta, assuming first stability scaling laws. The results indicate that on a purely economic basis, the DT fuel cycle is superior to both of the advanced fuel cycles. Geometric factor, materials limitations, and plasma beta were seen to have an impact on the Cost of Electricity (COE). The economics for the DD fuel cycle are more strongly affected by these parameters than is the DT fuel cycle. Fuel costs are a major factor in determining the COE for the DHe fuel cycle. Based on costs directly attributable to the fuel cycle, the DT fuel cycle appears most attractive. Technological advances, improved understanding of physics, or strides in advanced energy conversion schemes may result in altering the economic ranking of the fuel cycles indicated here.

4463 The TITAN oscillating-field current-drive system. Bathke, C.G. (Los Alamos National Lab., Los Alamos, NM 87545 (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The TITAN study uses oscillating-field current drive (OFCD) for steady-state operation in a reversed-field-pinch (RFP) fusion reactor. A circuit model which simulates the plasma, first wall, blanket, and coils has been developed and applied to two TITAN reactor designs to assess OFCD efficiency and power-supply requirements. Methods for optimizing current-drive efficiency and minimizing power-supply requirements are identified.

4464 Microwave superheaters for fusion. Campbell, R.B. (Lawrence Livermore National Lab., Livermore CA 94550 (USA)); Hoffman, M.A.; Logan, B.G. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The microwave superheater uses the synchrotron radiation from a thermonuclear plasma to heat gas seeded with an alkali metal to temperatures far above the temperature of material walls. It can improve the efficiency of the Compact Fusion Advanced Rankine (CFAR) cycle. For a proof-of-principle experiment using helium, calculations show that a gas superheat ΔT of 2000^0K is possible when the wall temperature is maintained at 1000^0K. The concept can be scaled to reactor grade systems. Because of the need for synchrotron radiation, the microwave superheater is best suited for use with plasmas burning an advanced fuel such as D-^{3}He.

4465 The lithium blanket program at the LOTUS facility. File, J. (Princeton Plasma Physics Lab., Princeton Univ., PO Box 451, Princeton, NJ 08544 (USA)); Haldy, P.A.; Quanci, J. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

An experimental program of neutron transport studies of the lithium Blanket Module (LBM) carried out with the LOTUS point-neutron source at the Ecole Polytechnique Federale de Lausanne (EPTL), Switzerland has been concluded. The major objectives of this program are to perform a series of neutron transport and tritium breeding experiments to qualify the LBM for future experiments on toroidal fusion devices such as TFTR to perform neutron multiplier experiments on the LBM employing various materials in a removable slab geometry; and, to compare the experimental results of radiation dosimetry and tritium breeding with the calculations of two and three dimensional neutron transport codes. An overview of the results from the radiation dosimetry and tritium assay are presented and compared to the two and three dimensional neutron transport codes.

4466 Neutronics design of self-cooled lithium blanket and shield for the high wall loading TITAN RFP reactor. Cheng, E.T. (GA Technologies Inc., PO Box 85608, San Diego, CA 92138 (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

As part of the high-power density TITAN RFP reactor study, a vanadium alloy-structured, self-cooled lithium blanket and shield concept was selected for detailed conceptual design study. The TITAN RFP reactor allows a high neutron wall loading of 18 MW/m^2. Tritium breeding, waste disposal, nuclear heating (both during operation and after shutdown), annual blanket replacement mass and protection of magnets are among the important issues taken into account in the neutronics design optimization. An important finding is that some nuclear performance characteristics such as decay heat, waste disposal rating, and atomic displacement in structural alloys are drastically reduced if the lithium is enriched with ^{6}Li. The ^{6}Li enrichment in lithium was chosen to be 30% in the Li/V design. The Li/V TITAN neutronic system consists of a 10 mm tube bank first wall, a 0.28 m blanket region, a 0.3 m reflector, a 0.15 m hot shield, and copper ohmic heating coils. The first wall and blanket components have a lifetime of one full power year. The reflector and shield are replaced every five full power years assuming the maximum atomic displacement limit in the vanadium alloy structure is 200 dpa. The ohmic heating coils are expected to last for the entire 30 full power years plant lifetime. The limiting factor is radiation damage to the spinel insulator. The tritium breeding ratio is 1.18 tritons per D-T neutron from a three-dimensional calculation, including the effect of the divertors. The nuclear performance of the above reference system satisfies all lifetime criteria in each reactor component.

4467 Blanket and shield design options for ASRA6C: A stellarator power reactor. . ElGuebaly, L.A. (Fusion Power Associates, 6515 Grand Teton Plaza, Madison, WI 53719 (USA)); Sviatoslavsky, I.N.; Sawan, M.E.; Wittenberg, L.J.; Kulcinski, G.L. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A major task of the ASRA6C study was to reduce the dimensions of the reactor by using a thin blanket and efficient shield. Four blanket options have been considered for ASRA6C. The main differences between the different options lie in the blanket geometry and in the way the blanket inner surface tracks the plasma contour. All blankets utilize liquid $Li_{17}Pb_{83}$ as the breeder, Be as the multiplier/moderator (except one option requires no Be), He gas as the coolant, and HT-9 as the structure. A comparison study between the four options was carried out on the basis of neutronics performance, configuration, maintainability, mass utilization, and economics. One option was selected on overall merits and is considered as the reference blanket design for ASRA6C. This blanket has a constant elliptical cross section and uniform thickness.

4468 Thermal-hydraulic design for the lithium-cooled TITAN reversed-field-pinch reactor. Hasan, M.Z. (Univ. of California at Los Angeles, Los Angeles, CA 90024-1597 (USA)); Blanchard, J.P.; Conn, R.W.; Cooke, P.I.H.; Ghoniem, N.M.; Grotz, S.P.; Najmabadi, F.; Orient, G.; Sharafat, S.; Wong, C. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A thermal-hydraulic design of the first wall and blanket of the 18 MW/m^2 neutron wall loading TITAN reversed-field-pinch (RFP) fusion reactor using liquid-lithium as coolant and V-3Ti-1Si as structural material is described. The first wall is made of tubes and the blanket coolant channels are a combination of tubular, square and rectangular channels. The coolant channels are aligned with the larger poloidal magnetic field. The first-wall and blanket coolant circuits are separate. Magnetohydrodynamic (MHD) turbulent-flow heat transfer is utilized when the heat flux on the first wall is high, allowing an extension of the design window up to about 5 MW/,m^2 heat

flux. The coolant velocities are 21 m/s in the first-wall and about 0-.5 m/s in the blanket coolant channels. The corresponding pressure drops are 10 MPa and 3.0 MPa, respectively. The coolant pumping power is about 53 MW which is less than 5% of the electric output. The coolant inlet temperature is 320^{0}C and the exit temperatures are 440^{0}C and 700^{0}C for the first-wall and blanket circuits, respectively. The maximum structure temperature is less than 75^{0}C and the material stresses are below the allowable design limits.

4469 Divertor design for the TITAN reversed-field-pinch reactor. Cooke, P.I.H. (Univ. of California at Los Angeles, Los Angeles, CA 90024-1597 (USA)); Bathke, C.G.; Blanchard, J.P.; Creedon, R.L.; Grotz, S.P.; Hasan, M.Z.; Orient, G.; Sharafat, S.; Werley, K.A. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The design of the toroidal-field divertor for the TITAN high-power-density reversed-field-pinch reactor is described. The heat flux on the divertor target is limited to acceptable levels ($\leq$ 10 MW/m^2) for liquid-lithium cooling by use of an open divertor geometry, strong radiation from the core and edge plasma, and careful shaping of the target surface. The divertor coils are based on the Integrated-Blanket-Coil approach to minimize the loss in breeding-blanket coverage due to the divertor. A tungsten-rhenium armour plate, chosen for reasons of sputtering resistance, and good thermal and mechanical properties, protects the vanadium-alloy coolant tubes.

4470 Structure and insulator material choices for the TITAN reversed-field-pinch reactor study. Sharafat, S. (Univ. of California at Los Angeles, Los Angeles, CA 90024-1597 (USA)); Ghoniem, N.M.; Cheng, E.; Cooke, P.I.H.; Grotz, S.; Martin, R.; Najmabadi, F.; Wong, C.P. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The structural material choice can significantly effect operating conditions, component lifetime, safety, and waste management issues of a fusion power reactor. A vanadium-base alloy (V-3Ti-1Si) was selected as structural material for the TITAN liquid lithium cooled reactor design. The choice was mainly based on the alloy's resistance to radiation damage and helium embrittlement. The behaviour of insulating materials can also have a significant effect on the overall reactor design, configuration and component lifetime. $MgAl_2O_4$ was taken as the choice insulating material based on its response to neutron irradiation. Lack of data in many areas such as creep-rupture and irradiation hardening, for structural materials; swelling and radiation induced conductivity for insulating materials prompted the authors to develop phenomenological design equations in order to estimate long term material behaviour.

4471 Ring coil optimization with respect to stress, temperature, and system energy over a range of physics requirements. Pillsbury, R.D. Jr (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, MA 02139 (USA)); Thome, R.J. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The poloidal field coil system for a tokamak can be divided into the central solenoid and the ring coils. A ring coil is defined as one that has a small cross-section compared to its diameter. The size of the central solenoid is usually fixed very early in the design process since its size is directly related to the tokamak size. The sizes of the other (ring) coils are not as critical to determining the basic machine size. It is necessary to know their locations and currents in order to verify the shaping and position control of the plasma. Attention is usually focused only on the baseline plasma of the design point. However, the PF set must also be able to shape and maintain other plasmas. This paper describes a program which evaluates PF coil current scenarios over a range of physics requirements and determines the sizes of the coils necessary to satisfy constraints on the temperature rise and stress levels for the worst case scenario. In addition, the system energy requirements can be assessed and trade-offs between system energy and coil sizes (cost) can be made. Examples are given based on studies performed of CIT (Compact Ignition Tokamak).

4472 High-field superconducting solenoids for the TIBER II PF system. Kerns, J.A. (Lawrence Livermore National Lab., Univ. of California, PO Box 5511, L-643, Livermore, CA 94550 (USA)); Miller, J.R.; Summers, L.T. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The poloidal-field (PF) coil set for the Tokamak Ignition/Burn Engineering Reactor (TIBER-II) consists of 24 Colenoid modules, 16 of which are stacked inside the toroidal-field (TF) system at the center of the machine. These central solenoid modules operate at windings approach 14 T. Although TIBER II is designed for steady-state operation with noninductive current drive, other operating scenarios are also considered. The central solenoid modules can easily support the centering load of the PF system, reducing the overall radial build of the machine and greatly increasing the limit on the number of pulse cycles imposed by fatigue considerations in the central solenoid.

4473 Cryogenic magnet case and distributed structural materials for high-field superconducting magnets. Summers, L.T. (Lawrence Livermore National Lab., Livermore, CA 94550 (USA)); Miller, J.R.; Kerns, J.A.; Myall, J.O. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The superconducting magnets of the Tokamak Ignition/Burn Experimental Reactor (TIBER II) will generate high magnetic fields over large bores. The resulting electromagnetic forces require the use of large volumes of distributed steel and thick magnet case for structural support. Reviews the design allowables, calculated loads and forces, and structural materials selection for TIBER II.

4474 Design process for the CIT (compact ignition tokamak) poloidal field coil system. Pillsbury, R.D. Jr. (MIT/Plasma Fusion Center, Cambridge, MA 02139 (USA)); Jardin, S.C.; Pomphery, D.N.; Thome, R.J. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The PF coil system for the CIT consists of a central solenoid and ten ring coils which are external to the bore of the toroidal field coil, together with six ring coils which are located within the bore of the TF coils. The baseline plasma carries 9 MA in a double null divertor configuration at an elongation of 2.0 and a triangularity of 0.3 (both at the 95% surface). This paper outlines the process used in selecting a PF coil set for CIT and gives an example of its capability. In particular, the plasma evolution for a case of interest is given together with system requirements in terms of coil size, power and energy. The ability of the coil system to dynamically control the flux surface position on the divertor plates is also illustrated.

4475 The VISTA spacecraft: Advantages of ICF for interplanetary fusion propulsion applications. . Orth, C.D. (Lawrence Livermore National Lab., L-481, PO Box 5508, Livermore, CA (USA)); Klein, G.; Sercel, J.; Hoffman, N.; Murray, K. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Inertial Confinement Fusion (ICF) is an attractive engine power source for interplanetary manned spacecraft, especially for near-term missions requiring minium flight duration, because ICF has inherently high power-to-mass ratios and high specific impulses. The authors have developed a new vehicle concept called VISTA that uses ICF and is capable of round-trip manned missions to Mars in 100 days using A.D. 2020 technology. They describe VISTA's engine operation, discuss associated plasma issues, and describe the advantages of DT fuel for near-term applications.

4476 Conceptual design of a 10-MJ driver for a high gain target development facility. Olson, R.E. (Target Experiments, Div.

1263, Sandia National Labs., Albuquerque, NM 87185 (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Commercial application of inertial confinement fusion (ICF) will require inexpensive, high gain (>80) fusion targets. It is thought that the development of such targets will require a 5 to 10 year search effort utilizing a dedicated nuclear research facility with a driver capable of providing a 10 MJ, 300 to 1000 TW pulse of on-target energy. The Terget Development Facility (TDF) is a light ion driven concept for such a facility. A TDF driver based upon extrapolations from present-day pulsed power technology is described in the present paper.

4477 Conceptual design of a high gain target development facility. Olson, R.E. (Sandia National Labs., Albuquerque, NM 87185 (USA)); Cook, D.L.; Moses, G.A.; Bruggink, D.; Engelstad, R.L.; Henderson, D.L.; Lovell, E.G.; Peterson, R.R.; Sawan, M.E.; Yasar, O. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Critical design issues associated with a light ion driven high gain Target Development Facility (TDF) have been explored in a preliminary conceptual design study. Calculational methods and key conclusions related to the TDF target chamber concept are described in the present paper.

4478 Measurements of electromagnetic properties of LCT coils in IFSMTF. Shen, S.S. (Oak Ridge National Lab., PO Box Y, Oak Ridge, TN 37831 (USA)); Baylor, L.R.; Dresner, L.; Fehling, D.T.; Lubell, M.S.; Lue, J.W.; Luton, J.N.; McManamy, T.J.; Wilson, C.T.; Wintenberg, R.E. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC05-84OR21400. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Participants in the international Large Coil Task (LCT) have designed, built, and tested six different toroidal field coils. Each coil has a 2.5- by 3.5-m, D-shaped bore and a current between 10 and 18 kA and is designed to demonstrate stable operation at 8 T, with a superimposed averaged pulsed field of 0.14 T in 1.0 s and simulated nuclear heating. Testing of the full six-coil toroidal array began early in 1986 and was successfully completed on September 3, 1987, in the International Fusion Superconducting Magnet Test Facility (IFSMTF) at Oak Ridge National Laboratory (ORNL). This paper summarizes electromagnetic properties of LCT coils measured in different modes of energization and fast dump. Effects of mutual coupling and induced eddy currents are analyzed and discussed. Measurements of the ac loss caused by the superimposed pulsed fields are summarized. Finally, the interpretation of the test results and their relevance to practical fusion are presented.

4479 Neutronics issues for a laboratory microfusion facility. Tobin, M.J. (Lawrence Livermore National Lab., PO Box 5508, Livermore, CA 94550 (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Discussion concerning goals or design of the Laboratory Microfusion Facility (LMF) should include an understanding of the neutronics issues involved. The authors consider such aspects as first wall shielding requirements, safety standards as they will apply to such an ICF facility, and the interior chamber environment. The selection of materials for the first wall, neutron moderator and absorber, and gamma ray shielding is discussed. They conclude that water or carbon are the choices for bulk neutron moderation and boron placed just in front of the first wall the choice for neutron absorber. Selection of the in-chamber materials and diagnostic design will greatly affect the relative hazards after a shot. Lead is the high-Z material of choice and plastic expendables for the diagnostics. Although a poor gamma ray attenuator, carbon is the choice for this function since it also compensates for the direct neutron shine effects and does not itself activate. Electronics may need to be hardened to the prompt gamma and neutron dose.

4480 Recent experiments with the Nova laser. Coleman, L.W. (Lawrence Livermore National Lab., CA (USA)). *Journal of Fusion Energy (USA),* 6(4): 319-327 (Dec 1987). (CONF-870457–: Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies, Pleasanton, CA (USA), 8-9 Apr 1987).

Experiments conducted at the Nova facility in laser fusion under the auspices of the inertial confinement fusion program are discussed. Research in the production of fusion conditions in the laboratory and in the development of high-power neodymium lasers is assessed. Target and plasma developments are evaluated along with neutron diagnostics using time-of-flight spectrometers and x-ray framing cameras. An inertial confinement fusion power plant using the Cascade reactor is described from the standpoint of cost and efficiency.

4481 Applications of free-electron laser technology to magnetic fusion. Thomassen, K. (Lawrence Livermore National Lab., CA (USA)). *Journal of Fusion Energy (USA),* 6(4): 361-363 (Dec 1987). DOE Contract W-7405-ENG-48. (CONF-870457–: Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies, Pleasanton, CA (USA), 8-9 Apr 1987).

The use of free electron laser technology in a program at Lawrence Livermore for the electron cyclotron heating of a takamak plasma is discussed. The program will use the ETA-II facility now being constructed for accelerator and laser research and will involve moving the former Alcator C tokamak from MIT and housing it in the building now containing the MFTF-B mirror machine. The ETA-II facility butts into the MFTF-B building. Microwaves will be transmitted to the tokamak from this area via a quasi-optical system with large mirrors to steer and focus the microwaves into the plasma. The program proposes to generate up to 2 MW of power at 250 GHz. The laser will amplify signals generated by a 10-kW gyrotron operating in a second harmonic whispering gallery mode. The program is called the microwave tokamak experiment.

4482 Cusp-stabilized mirror-based neutron source. Kesner, J. (Massachusetts Institute of Technology, Cambridge (USA)); Horne, S.F.; Pastukhov, V.P. *Journal of Fusion Energy (USA),* 6(4): 401-411 (Dec 1987). DOE Contract AC02-78ET51013. (CONF-870457–: Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies, Pleasanton, CA (USA), 8-9 Apr 1987).

An optimally sized Fusion Engineering Test Facility should produce 10-20 MW of power at 2 MW/m^2 steady-state wall loading. Because mirror cells do not scale with size, one can choose the fusion power and wall loading free from minimum size constraints. A cusp stabilized axisymmetric mirror is seen to be ideally suited for this purpose due to excellent access, a simple coil set, and good MHD properties. The authors present parameters for a proof of principle experiment as well as for a neutron source facility.

4483 Neutral beam injection current drive sensitivity study for the tokamak ignition/burn experimental reactor II, the U.S.: Option for International Thermonuclear Reactor, and the International Tokamak Reactor. . Pautasso, G.R. (Georgia Inst. of Tech., Atlanta, GA (USA). Fusion Research Center); Mandrekas, J.; Stacey, W.M. Jr. *Fusion Technology (USA),* 15(3): 1395-1400 (May 1989).

In this paper the current driven by neutral beam injection is calculated for three different reactor designs: the Tokamak Ignition/Burn Experimental Reactor II (TIBER-II), the U.S. option for the International Thermonuclear Experimental Reactor (ITER-US), and the International Tokamak Reactor (INTOR). The sensitivity of the current drive efficiency to plasma and beam parameters is studied, and general conclusions are drawn.

4484 Cryogenic-laser-fusion target implosion studies performed with the OMEGA uv-laser system. Marshall, F.J.; Letzring, S.A.; Verdon, C.P.; Skupsky, S.; Keck, R.L.; Knauer, J.P.; Kremens, R.L.; Bradley, D.K.; Kessler, T.; Delettrez, J.; and others. *Physical Review [Section] A: General Physics (USA),* 40(5): 2547-2557 (1 Sep 1989).

A series of direct-drive laser-fusion implosion experiments was performed on cryogenically cooled, DT-filled glass microballoons

with the OMEGA 24-beam uv (351-nm) laser system. The targets consisted of glass microballoons having radii of 100 to 150 μm, wall thicknesses of 3 to 7 μm, filled with DT gas at pressures of 75 to 100 atm. The targets were cooled to below the freezing point of DT, *in situ*, by a cryogenic target system. The targets were irradiated by approximately 1 to 1.2 kJ of uv light in 650-ps Gaussian pulses. The on-target irradiation uniformity was enhanced for these experiments by the use of distributed phase plates, which brought the estimated irradiation nonuniformities to ~12% (σ_{rms}). Target performance was diagnosed by an array of x-ray, plasma, and nuclear instruments. The measured target performance showed ~70% absorption, thermonuclear yields of 10^6 to 10^8 neutrons, and final fuel areal densities of 20 to 40 mg/cm^2 for the optimum targets examined in these experiments. Fuel densities at the time of thermonuclear neutron production, inferred from direct measurements of the fuel areal density, were in the range of 20 to 50 g/cm^3 (100 to 200 times the density of liquid DT) for the optimum targets.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 2607

4485 (CRN-RA–1987) **CRN: 1987 Progress Report.** Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1988. 362p. (In French). Order Number DE90721245. Available from NTIS (US Sales Only), PC A16/MF A01.

In the Nuclear Research Center activity report, the research works effected in each of the following departments are shown: Nuclear Physics: theoretical and experimental Nuclear Physics Works, technical studies, accomplishments and applications, the Vivitron, publications, conferences and diplomas. High Energies: theoretical and experimental Physics, the LEP-DELPHI project, the NA36 experiment (strange baryons and antibaryons production in relativistic ions collisions), technical developments, publications, conferences and diplomas. Radiation Chemistry and Physics (research reports are separated in six sections): (1) Molecular and Atomic Physics and Physical Chemistry, where the main subjects are Molecular Physics, matter-radiation interactions, positon and positronium chemistry and radiochemistry; (2) Materials Science and condensed matter studies, in which the main topics are the materials elaboration and characterization, Mossbauer spectroscopy and defect implantations; (3) Analysis and instrumentation describing short time applied Optics and sensors; (4) The nuclear reactor service with neutron activation analysis and short life radioisotopes; (5) Publications, communications, conferences, thesis and researchers' stay; (6) Technology transfers concerning accelerators, dosimetry and aliments ionization.

4486 (IAERU–8802) **Proceedings of Institute for Atomic Energy, Rikkyo University (IAERU) seminar-4.** Tomura, Kenji; Kobayashi, Hisao (eds.). Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy. Mar 1989. 140p. (CONF-8806441–: 4. IAERU seminar, Tokyo (Japan), 18 Jun 1988). Order Number DE90705939. Available from NTIS (US Sales Only), PC A07/MF A01.

Individual items in scope for the data base are processed separately. (DLC)

4487 (LA–11634-MS) **Analysis of physical training of security inspectors at Los Alamos National Laboratory: A preliminary report.** Burkhalter, H.E.; Tietjen, G.L.; Sessions, J.C.; Hook, T.R. Los Alamos National Lab., NM (USA). Nov 1989. 29p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90002337. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

One-half and one-mile runs and 40-yard dash times were analyzed for security inspectors (SIs) at Los Alamos National Laboratory. The effectiveness of grip-strength conditioning was also determined. Both males and females met running sprint standards well within the limits established by the Department of Energy, and there were no adverse effects among any age decades or either gender. Reducing training from three to two days per week resulted in a statistically significant decrease in qualification performance. Increase in grip strength was noted in the left hand only when SIs trained two days per week for nine weeks. Further analysis should determine the appropriate training frequency for this population. These results suggest that no significant improvement is derived from aerobic training occurring less than three days per week. 7 refs., 19 figs.

4488 (UCID–21674) **Kestrel 3 Program: Final report.** Chocol, C.; Massey, W.; Hoard, R.; Hendricks, J.; Newman, M. Lawrence Livermore National Lab., CA (USA). 17 Apr 1989. 123p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90001796. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report contains information on the major subsystems of the Kestrel balloon system. Detailed data are provided in areas where major design and subsystem testing have taken place. Data are also provided on test support equipment, data acquisition, test conditions, assembly, and procedures within the Pacific Missile Test Center (PMTC) range, where testing occurred. 22 figs.

9901 Management

Refer also to citation(s) 2492, 2753, 3687, 4536

4489 (DOE/MA–0384) **Technical skills training program: Program management, project management, procurement and assistance.** USDOE Assistant Secretary for Management and Administration, Washington, DC (USA). Employee Development and Training Div. Oct 1989. 55p. Sponsored by U.S. DOE Management & Administration. Order Number DE90002690. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The departmentally administered Technical Skills Training Program encompasses three functional areas: Program Management Skills, Project Management Skills and Procurement and Assistance Skills Training. Primary emphasis is directed at providing DOE employees the specific work related skills necessary to perform effectively and efficiently. This directory contains descriptions of the courses available in the three program areas and general information for participation in the training programs. Separate sections have been reserved for the Current Year Schedule and listings of the Headquarters and Field Training Office Coordinators.

4490 (DOE/MA/19117–T1) **The effective supervision seminar the management development seminar: Final project report.** Delaurenti (Jordan), Inc., Dallas, TX (USA). Sep 1989. 184p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC01-86MA19117. Order Number DE90003092. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The Department of Energy (DOE) has been providing the Effective Supervision Seminar (ESS) on a regular basis since 1978. The course is primarily targeted for new, probationary DOE supervisors. Incumbent supervisors who have not had equivalent training or haven't had supervisory training for the past five years are also eligible to participate in ESS as are non-supervisory employees whose need for the training can be justified under special circumstances. The ESS program fulfills 40 hours of the 80 hours of supervisory training that is required for DOE supervisors. The course is intended to enable the participants to understand supervisory methods and techniques and to apply interpersonal skills and supervisory principles in carrying out their duties as DOE supervisors. The mandatory nature of the ESS program, when coupled with the extremely broad diversity of technical and professional occupational fields that are represented in DOE headquarters and field operations, makes the achievement of these objectives particularly challenging and rewarding.

4491 (FNAL/C–89/194) **New directions for QA in basic research: The Fermilab/DOE-CH experience.** Bodnarczuk, M. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8910228–1: DOE quality assurance workshop, Idaho Falls, ID (USA), 3-4 Oct 1989). Order Number DE90001574. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper addresses the underlying problems involved in developing institution-wide QA programs at DOE funded basic research facilities, and suggests concrete ways in which QA professionals and basic researchers can find common ground in describing and analyzing those activities to the satisfaction of both communities.

The paper is designed to be a springboard into workshop discussions which can define a path for developing institution-wide QA programs based on the experience gained with DOE-CH and Fermilab.

4492 (IAEA-INFCIRC–2(Rev.37)) **Members of the Agency. List of 1 September 1989.** International Atomic Energy Agency, Vienna (Austria). Sep 1989. 1p. Order Number DE90608889. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The Revision of INFCIRC/2 has been issued in order to inform Member States of a change of name, from "Burma" to "Myanmar" among 113 Members of the Agency on 1 September 1989.

4493 (INIS-BR–1745) **Description of the objectives and activities of Radioprotection and Dosimetry Institute - IRD.** Almeida, C.E. de. Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil). [1989]. 32p. (In Portuguese). Order Number DE90608891. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The organizational structure and the research programs developed by Dosimetry and Radioprotection Institute - IRD from Brazilian Nuclear Energy Commission are presented.

4494 (IPEN-PUB–219) **Activities of the neutron activation analysis laboratory of the radiochemistry division of IPEN - CNEN/SP.** Vasconcellos, M.B.A. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Oct 1988. 17p. (In Portuguese). Order Number DE90608892. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Neutron activation analysis (NAA) is one of the relevant applications of nuclear research reactors. Due to the high neutron fluxes available in these reactors, an excellent sensitivity of analysis is attained for many elements. NAA is one of the most sensitive, precise and accurate analytical methods for trace element determination. NAA has been one of the main activities of the Radiochemistry Division of IPEN, since the beginning of the operation of the nuclear reactor IEA-R1. Most of the effort was devoted to research work, aimed to improvements in the method as well as to its applications to several kinds of matrixes (geological, biological, metallic, environmental, forensic). Besides, analytical services were also offered, to the CNEN, to industries, universities, mining companies and research institutes. In the present paper, a review is made of the research work being developed presently at the Radiochesmitry Division of IPEN. A discussion is also made of the planned expansion of the analytical services offered.

4495 (PNL-SA–17004) **Quality oversight in research and development.** Christensen, J.A. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8909110–8: 16. annual conference of the American Society for Quality Control, Fort Lauderdale, FL (USA), 17-20 Sep 1989). Order Number DE90002675. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In our work for the NRC in developing regulatory approaches for controlling licensee quality assurance programs and for DOE-RL and the US Army in developing quality programs, we have learned much about the character and content of functional approaches to quality improvement. We have verified the importance of experience, commitment, management involvement, organizational structure, contracting practices, substance versus form, training, documentation/verification, audit programs, corrective action, trending, independent review, design and procurement control, etc., and have generated hundreds (perhaps thousands) of pages of prose documenting and analyzing these observations. During this process, it has become clear that there are some very basic, almost simplistic, attributes of quality programs that signal their likely success or failure. 4 figs.

4496 (UJV–8715-V) **List of publications 1988.** Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). 10 Mar 1989. 50p. (In Czech, English). Order Number DE90608893. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A list is given of reports, articles published in or submitted to journals, theses, conference papers, patents and reports only for internal use, published by the Nuclear Research Institute staff in 1988.

9902 Mathematics and Computers

Refer also to citation(s) 2092, 2105, 2115, 2116, 2148, 2183, 2191, 2194, 2195, 2215, 2216, 2217, 2234, 2238, 2247, 2259, 2298, 2301, 2311, 2312, 2325, 2326, 2330, 2342, 2348, 2383, 2387, 2391, 2392, 2393, 2394, 2398, 2399, 2401, 2404, 2411, 2415, 2419, 2439, 2455, 2458, 2470, 2474, 2478, 2481, 2482, 2483, 2484, 2485, 2489, 2496, 2500, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2513, 2515, 2516, 2517, 2518, 2520, 2525, 2526, 2528, 2541, 2546, 2547, 2549, 2550, 2551, 2552, 2581, 2583, 2586, 2596, 2597, 2610, 2794, 2797, 2804, 2836, 2838, 2944, 2969, 3107, 3130, 3138, 3187, 3214, 3216, 3220, 3225, 3227, 3234, 3297, 3298, 3353, 3378, 3468, 3483, 3595, 3780, 3895, 3937, 4181, 4310, 4339, 4355, 4356, 4357, 4358, 4397, 4404, 4412, 4445, 4458, 4459, 4463, 4471, 4545, 4546, 4549

4497 (AD-A–207609/9/XAB) **Implementation indices (1975-1979). Volume 1. Technical report.** Papadopoulos, G.M. Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Computer Science. Dec 1988. 158p. (MIT/CS/TR–432). Available from NTIS, PC A08/MF A01.

General-purpose multiprocessors have largely failed to meet expectations for programmability and performance. We blame the lack of usable parallel programming languages and systems on the underlying processor architecture. Machines built out of conventional sequential processors simply do not support the synchronization demands of parallel execution, so the programmer focuses upon the dangerous and arduous task of discovering a minimum set of synchronization points without introducing nondeterminism. The authors argues that processors must be fundamentally changed to execute a parallel machine language, in which parallel activities are coordinated as efficiently as instructions are scheduled.

4498 (AD-A–210330/7/XAB) **Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987.** Lesser, V.; Croft, W.B.; Woolf, B. Syracuse Univ., NY (USA). Mar 1989. 591p. Available from NTIS, PC A25/MF A01.

The Northeast Artificial Intelligence Consortium (NAIC) was created to conduct pertinent research in artificial intelligence and to perform activities ancillary to this research. The topics covered in general are: versatile expert system for equipment maintenance, distributed AI for communications system control, automatic photo interpretation, time-oriented problem solving, speech understanding systems, knowledge base maintenance, hardware architectures for very large systems, knowledge-based reasoning and planning, and a knowledge acquisition, assistance, and explanation system. The specific topic for this volume is the development of intelligent interfaces to support cooperating computer users in their interactions with a computer.

4499 (AD-A–210331/5/XAB) **Northeast Artificial Intelligence Consortium annual report for 1987. Volume 7. Part A. Time oriented problem solving. Interim report, December 1986-December 1987.** Allen, J.F. Syracuse Univ., NY (USA). Mar 1989. 342p. Available from NTIS, PC A15/MF A01.

The Northeast Artificial Intelligence Consortium (NAIC) was created to conduct pertinent research in artificial intelligence. The topics covered in general are: versatile expert system for equipment maintenance, distributed AI for communications-system control, automatic photo interpretation, time-oriented problem solving, speech-understanding systems, knowledge-base maintenance, hardware architectures for very large systems, knowledge-based reasoning and planning, and a knowledge-acquisition, assistance, and explanation system. The specific topic for this volume is a model theory and axiomatization of a logic for reasoning about planning in domains of concurrent actions.

4500 (AD-A–210528/6/XAB) **Rewrite Rule Machine project. Final report.** Goguen, J.A.; Meseguer, J.; Leinwand, S.; Winkler, T.; Aida, H. SRI International, Menlo Park, CA (USA). 1 May 1989. 24p. (SRI-ECU–1243). Available from NTIS, PC A03/MF A01.

Current-generation parallel machines are typically either coarse-grain or fine-grain. Each design has certain limits, either in the amount of parallelism that it can effectively exploit, or else in the

types of problem for which it is suitable. For example, only very homogeneous computations can make efficient use of today's fine-grained machines. However, many complex computations are locally homogeneous, but not globally homogeneous. The Rewrite Rule Machine (RRM) resolves this dilemma through its hierarchical architecture, which has several levels of organization. The lowest level is the cell, which stores a token and pointers to other cells; this organization avoids the von Neumann memory access bottleneck. Next, an ensemble contains many cells, representing a complex data structure to which rewrite rules are applied under the direction of a common controller. A cluster consists of many ensembles which cooperate in larger computations. Ensembles support fine-grained homogeneous parallelism, while clusters support coarse-grained inhomogeneous parallelism. This multi-grained parallelism allows the RRM to exploit the local homogeneity that is typical of many complex computations. The RRM can support the efficient execution of many different programming paradigms by compiling them into its concurrent rewriting model of computation.

4501 (AD-A–210722/5/XAB) **Optimization algorithms for new computer architectures with applications to personnel-assignment models. Annual report (Final), 1 May 1988-30 April 1989.** Kennington, J.L.; Helgason, R.V. Southern Methodist Univ., Dallas, TX (USA). Dept. of Computer Science and Engineering. 29 Jun 1989. 97p. (SMU–5-25105). Available from NTIS, PC A05/MF A01.

One of the most important computer architecture innovations to appear in the marketplace during the last ten years is parallel processing on a shared memory multicomputer. This report presents empirical results on a Sequent Symmetry S81 on four optimization models used in the area of personnel assignment. Both the detailed algorithms and computational results are presented. Contents: Minimal Spanning Trees - An Empirical Investigation of Parallel Algorithms; Dijkstra's Two-tree Shortest Path Algorithm; An Empirical Analysis of the Dense Assignment Problem; and Solving Generalized Network Problems on a Shared Memory Multiprocessor.

4502 (AD-A–210743/1/XAB) **Computational and statistical issues in discrete-event simulation. Technical report.** Glynn, P.W.; Iglehart, D.L. Stanford Univ., CA (USA). Dept. of Operations Research. Mar 1989. 18p. (TR–33). Available from NTIS, PC A03/MF A01.

Discrete-event simulation is one of the most important techniques available for studying complex stochastic systems. This paper first reviews the principal methods available for analyzing both the transient and steady-state simulation problems in sequential and parallel-computing environments. Next, several of the variance reduction methods designed to make simulations run more efficiently are discussed. Finally, a short discussion is given of the methods available to study optimization using simulation.

4503 (AD-A–210760/5/XAB) **Research, development, training, and education using the Ada programming language. Final report, 1 September 1987-31 May 1989.** Harrison, G.C. Norfolk State Univ., VA (USA). 16 Jul 1989. 18p. Available from NTIS, PC A03/MF A01.

The primary goal of this activity was to conduct research in the application and development of Ada, and in broader terms the objectives were as follows: (1) To develop numerical algorithms for parallel processing using the Ada language; (2) To develop new methodologies in reusing Ada software; (3) To solve select problems in applied mathematics using MACSYMA and Ada; (4) Simulate the interactions of nodes in a network using Ada; (5) To increase the cadre of educations available to provide Ada training by conducting Ada workshops for Norfolk State University faculty and staff; (6) To develop a series of in-class and individualized modules addressing Ada programming using computer-assisted instruction; and (7) To disseminate research and computer-aided instruction modules to other minority institutions through computer networking, workshops, and lecture series.

4504 (ANL–89/2-Rev.1) **Rationale for the proposed standard for a generic package of elementary functions for Ada: Revision 1.** Dritz, K.W. Argonne National Lab., IL (USA). Oct 1989. 15p. Sponsored by U.S. Department of Defense. DOE Contract W-31109-ENG-38. Order Number DE90002925. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper supplements the "Proposed Standard for a Generic Package of Elementary Functions for Ada," written by the ISO-IEC/JTC1/SC22/WG9 (Ada) Numerics Rapporteur Group. Based on recommendations made jointly by the ACM SIGAda Numerics Working Group and the Ada-Europe Numerics Working Group, the proposed elementary functions standard is the first of several anticipated collateral standards to address the interrelated issues of portability, efficiency, and robustness of numerical software written in Ada. Organized as a series of questions and answers, this supplement outlines the reasoning by which the proposed standard came to acquire certain features and exclude others. 22 refs.

4505 (ANL/EES-TM–378) **IDEA—Interactive Decision Analysis: Users' guide and tutorial.** Whitfield, R.G.; Swietlik, C.E.; Warren, M.F.; Fuja, R.; Jusko, M.J.; Peerenboom, J.P.; Johnson, E.C. Argonne National Lab., IL (USA). Sep 1989. 95p. Sponsored by U.S. Department of Defense. DOE Contract W-31109-ENG-38. Order Number DE90001782. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The IDEA (Interactive DEcision Analysis) software package comprises IBM PC (and compatible) procedures for evaluating decision problems characterized by alternative courses of action, uncertainty, and multiple conflicting objectives. Multiattribute decision analysis provides the theoretical underpinnings for IDEA. In IDEA, the attributes (measures of effectiveness of the objectives) are assumed to be probabilistically independent. This assumption enables evaluation of decision problems having large numbers of alternatives and attributes. IDEA is a file-based system. Data entry is facilitated by the FORMS package, a set of special-purpose procedures that provides for data entry via customized forms (spread sheets), cues and prompts for every input field in the form, detection of invalid entries, on-line help documentation, and control of screen attributes. If assistance is needed to complete the input forms, the following on-line "consultants" are available: the probability consultant, the single-attribute utility function consultant, and the multiattribute utility function consultant. These modules – accessible by pressing function keys – simulate probability and utility encoding sessions with a decision analyst. Computational results are written to the screen and files. A variety of sensitivity analyses are available, the results of which are displayed in both tabular and graphical form. A CGA (or higher) card and DOS 2.0 (or higher) are required. 16 refs.

4506 (ANL/PPRNT–89-195) **The problem of finding a strategy in control binary paramodulation.** Wos, L. Argonne National Lab., IL (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90003007. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This article is the fifth of a series of articles discussing various open research problems in automated reasoning. Here we focus on the equality relation which is so vital to many applications of automated reasoning. The problem proposed for research asks one to find a strategy for controlling the application of binary paramodulation. For evaluating a proposed solution to this research problem, we include suggestions concerning possible test problems. 13 refs.

4507 (CEA-N—2606) **Dirac-Fock calculations in multi-harmonic-oscillator basis.** Chaix, P.; Decharge, J.; Iracane, D. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1989. 66p. (In French). Order Number DE90721138. Available from NTIS (US Sales Only), PC A04/MF A01.

Atomic relativistic calculations in a basis composed of eigenvectors of several harmonic oscillators are presented. Variational collapse and related problems that arise when using finite basis sets, are discussed. The examination of the non relativistic limit leads to a prescription on the basis. This prescription seems to allow safe calculations even in the relativistic domain. A code has been developed using this prescription and some specific properties of harmonic oscillator wave functions. We were able to calculate many electron systems. Present predictions are compared with those of the DF of Desclaux in which finite difference methods are used for solving DF equations in r space.

4508 (CONF-8903169–2) **The parallel performance of Schwarz splitting.** Ribbens, C.J.; Watson, L.T. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). 23 Oct 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER25068. (CONF-8907164–1: 3. SIAM conference on domain decomposition methods; Society for Industrial and Applied Mathematics (SIAM) national meeting, Houston, TX (USA); San Diego, CA (USA), 20-22 Mar 1989; 16-21 jul 1989). Order Number DE90002695. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We describe several experiments with implementations of Schwarz splitting algorithms for the numerical solution of elliptic partial differential equations. Results from experiments comparing several variations of the basic scheme in the context of real parallel implementations are presented. Both shared-memory and distributed-memory architectures are represented. Various possibilities for accelerating the Schwarz iteration and for solving the subdomain problems are considered, with particular emphasis on the resulting parallel performance. 21 refs., 3 figs., 7 tabs.

4509 (CONF-8904288–1) **The interesting future of supercomputing.** Stevens, R.L. Argonne National Lab., IL (USA). May 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Computer and geophysical research conference; Houston, TX (USA); 24-26 Apr 1989. Order Number DE90002263. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses the likely future direction of supercomputing. (LSP)

4510 (CONF-8908178–1) **A comparison result and elliptic equations involving subcritical exponents.** Kwong, Man Kam. Argonne National Lab., IL (USA). [1989]. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on nonlinear diffusion equations and their equilibrium states; Newton (UK); 20-29 Aug 1989. Order Number DE90001772. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

It is well known that good bounds for solutions of nonlinear differential equations are difficult to obtain. In this paper, we establish a theorem comparing non-negative solutions (having identical initial values) of the equations $u''(t) + q(t)u^p(t) + r(t)u(t) = 0$ and $v''(t) + k(t)q(t)v^p(t) + r(t)u(t) = 0$, respectively. If $q(t)$, $r(t) \geq 0$, $k(t) \geq 1$, $k(t)$ is nondecreasing, and the first equation satisfies a certain uniqueness criterion, our result asserts that $u(t) \geq v(t)$. Both the uniqueness assumption on the equation and the monotonicity requirement on $k(t)$ are necessary. A particular case of this theorem plays a central role in a recent paper of Atkinson and Peletier in the study of asymptotic behavior of nonlinear elliptic equations involving a critical exponent. A simple corollary of our result provides information on the same type of equations with subcritical exponents. 13 refs.

4511 (CONF-8910284–1) **How would you know an intelligent system if you saw one?.** Glover, C.W. Oak Ridge National Lab., TN (USA). 1989. 9p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract AC05-84OR21400. 1579-1579-A1. From Aerospace applications of artificial intelligence conference; Dayton, OH (USA); 24-27 Oct 1989. Order Number DE90002472. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper advocates that the study of intelligent systems is a science in its infancy, and there is an urgent need to reduce the ambiguity in definitions of the terms used throughout intelligent systems science. For example, researchers do not agree on what an "intelligent system" is, or how to measure the intelligence within a system. This paper, as an exercise, presents a strawman definition and measure of a system's intelligence, and discusses some of the problems that can arise when measuring intelligence. Not everyone is expected to agree with the strawman definition of intelligence. The primary purpose for presenting it is to stimulate thought, and to challenge the readers to continue the exercise and develop their own measure of intelligence. Maybe, at some point we as researchers can converge on a working quantitative measure of intelligence. 1 ref., 3 figs.

4512 (CONF-8910288–1) **Strand: A practical parallel programming language.** Foster, I.; Taylor, S. Argonne National Lab., IL (USA). [1989]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From North American conference on logic programming; Cleveland, OH (USA); 16-20 Oct 1989. Order Number DE90002861. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Effective parallel programming requires tools that facilitate the design and implementation of parallel algorithms and provide portability across parallel computers. Strand is the first such tool to be available on a broad range of multiprocessor architectures, including hypercubes, meshes, computing surfaces, banyan networks, shared-memory machines and local area networks. Strand is a new concurrent logic programming language. Its design is motivated by extensive experience with previous languages of this type. This experience indicated that for most practical parallel programming requirements, these research languages were too complex, inefficient and difficult to implement. Strand applies a broad variety of simplifications to achieve a practical parallel programming tool. This paper describes the issues surrounding the Strand design and reports on initial experiences with the language. 24 refs., 3 figs.

4513 (DOE/ER/25068–1) **Parallel mathematical software: Technical progress report, September 16, 1988–February 14, 1990.** Ribbens, C.J.; Watson, L.T. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Dept. of Computer Science. Oct 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER25068. Order Number DE90002694. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of this report is to summarize work done during the first 18 months on the project "Parallel Mathematical Software," supported by the US Department of Energy. Since the two major problem domains for this research are elliptic partial differential equations (and the software package ELLPACK) and systems of nonlinear equations (and the software package HOMPACK), we organize this report into two major sections. This paper details aspects of our work that relate to ELLPACK; and discusses progress in connection with HOMPACK.

4514 (EGG-M–88277) **Solution bias in complex systems modeling.** Kaplan, B.; Mecherikoff, M.; Blackman, H. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1988]. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881058–6: Human Factors Society annual meeting, Anaheim, CA (USA), 24-28 Oct 1988). Order Number DE90002001. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Each discipline tends to use analytic tools that lead them to solutions within their own discipline, and steer them away from others. Within a discipline, we tend to pose solutions that align with our areas of interest or expertise. Clients can be guided into work which may not be the best solution to their particular set of problems or needs.

4515 (EGG-M–89380) **INEL [Idaho National Engineering Laboratory] support to modernization efforts at the Aberdeen Proving Ground.** Larson, T.K.; Fink, R.K.; Powell, R.H.; Cordes, G.A.; Brown, C.B.; Francis, C.L.; Murter, J.S.; Shrader, T.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8910294–1: Conference on AI in the DOE complex, Los Alamos, NM (USA), 17-19 Oct 1989). Order Number DE90002045. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Army Combat Systems Test Activity (USACSTA) at Aberdeen Proving Ground (APG), MD supports the test and evaluation of Army material. The Instrumentation Development Division of USACSTA is currently effecting a thorough modernization of hardware, software, and operating procedures that support testing in order to standardize testing operations and to increase efficiency and cost effectiveness. Part of the modernization effort includes examination of new software techniques to see if such methods contribute to the modernization effort. The Idaho National Engineering Laboratory (INEL) has been supporting the USACSTA in the examination of artificial intelligence (AI) techniques in the modernization efforts. Two USACSTA specified task areas are being approached using AI methods. Preliminary results suggest that AI approaches can contribute to the modernization efforts by helping to capture and

preserve expert "know-how" in specific problem domains and application of this expertise in an automated fashion. 3 refs., 4 figs.

4516 (FNAL/C–89/172) **Weighted fit of parametric functions to distributions: The new interface of HOBOOK with MINUIT.** Lessner, E.S. Fermi National Accelerator Lab., Batavia, IL (USA). Aug 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890415–11: Computing in high energy physics, Oxford (UK), 10-14 Apr 1989). Order Number DE90002916. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The fitting routines of the HBOOK package allow weighted fit of parametric functions to the contents of a one, two or N-dimensional distribution, and analysis of the function in the neighborhood of its minimum, through an interface with the MINUIT package. These routines have been rewritten so as to interface the new version of MINUIT and to allow for smooth transitions to future versions of both packages. We discuss the interface and its capabilities: it is more stable than the previous version and presents a more accurate error analysis. The fitting algorithm is based on the Fletcher method, known for its reliability. Exponential, Gaussian and polynomial fitting are provided, as well as arbitrary user-defined fitting, to one, two and N-dimensional distributions. For the latter, the user is required to provide a smooth parametric function and is given the ability to guide the algorithm in finding the desired minimum. Examples are given. 6 refs., 1 fig.

4517 (INIS-mf–12013, pp. 46) **Electronics for online and data acquisition.** Nouvel, P.; Heck, U.; Menzer, R.; Thiel, P. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

Published in summary form only. DATA ACQUISITION SYSTEMS/logic circuits; DEC COMPUTERS; PDP COMPUTERS; PROCESS COMPUTERS; MAGNETIC DISKS; ON-LINE SYSTEMS; INTERACTIVE DISPLAY DEVICES; ANALOG-TO-DIGITAL CONVERTERS; CAMAC SYSTEM; TIME-TO-AMPLITUDE CONVERTERS; DATA ACQUISITION

4518 (JINR-E–11-89-174) **Iterative methods of domain decomposition with cross-points for the solution of discrete elliptic problems.** Zhidkov, E.P.; Mazurkevich, G.E.; Khoromsky, B.N. Joint Inst. for Nuclear Research, Dubna (USSR). 1989. 23p. Order Number DE90000719. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

A method of domain decomposition with cross-points (box decomposition) is used for the solution of finite-difference elliptic boundary value problems in rectangle and in parallelepiped. Capacitance matrix and preconditioners for iterative solution of arising algebraic problem are constructed by means of Poincare-Steklov operators. The convergence properties of iterative algorithms depend on local characteristics of subdomains on the number "N" of unknowns in one direction in subdomains, and are independent of the number of subdomains and of jumps of elliptic operator coefficients as long as these jumps only occur across the subdomain boundaries. The dependence of convergence on discretization of the problem is defined by "ln N" for two-dimensional problems, by "$\sqrt{N}$ ln N" for three-dimensional problems. The results of numerical experiments illustrating convergence properties are presented. 18 refs., 3 figs., 4 tabs.

4519 (KFK–4527) **Algorithms and programs for evaluating fault trees with multi-state components.** Wickenhaeuser, A. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung. Jul 1989. 82p. (In German). Order Number DE90722072. Available from NTIS (US Sales Only), PC A05/MF A01.

Part 1 and 2 of the report contain a summary overview of methods and algorithms for the solution of fault tree analysis problems. The following points are treated in detail: Treatment of fault tree components with more than two states. Acceleration of the solution algorithms. Decomposition and modularization of extensive systems. Calculation of the structural function and the exact occurrence probability. Treatment of statistical dependencies. A flexible tool to be employed in solving these problems is the method of forming Boolean variables with restrictions. In this way, components with more than two states can be treated, the possibilities of forming modules expanded, and statistical dependencies treated. Part 3 contains descriptions of the MUSTAFA, MUSTAMO, PASPI, and SIMUST computer programs based on these methods. (orig./HP).

4520 (LBL–26796) **Scry: A distributed image handling system: Version 1.1.** Robertson, D.W.; Johnston, W.E.; Chua, Teck-Joo; Huang, J.; Renema, F.; Rible, M.; Texier, N.; Wishinsky, B.J. Lawrence Berkeley Lab., CA (USA). Apr 1989. 60p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90003105. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Scry is a distributed image handling system that provides both image compression and transport on local and wide area networks, and a collection of higher level graphics and scientific visualization functions. The system can be distributed among workstations, between supercomputers and workstations, and between supercomputers, workstations and video animation controllers. The system is most commonly used to produce video based movie displays of time dependent data and complex 3D data sets, and to handle the images resulting from certain image processing operations. In the scientific visualization process, the system is typically used in one of two configurations. In the first, the supercomputer application generates data (e.g. flow field vectors) that are compressed and sent to a graphics workstation over a wide area network. The graphics workstation environment is used to design and debug the graphics visualization for a movie. Finally, the raster images that represent the frames of the movie are compressed and sent over a local area network to the video animation controller. This report discusses the use of this program.

4521 (LBL–27680) **Effect of media properties on side erase bands.** Lin, K.C.; Thomas, G.; Gau, G.J.S. Lawrence Berkeley Lab., CA (USA). Sep 1989. 12p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC03-76SF00098. DMR-8707241E. (CONF-8909246–1: Magnetic recording media conference, Rimini (Italy), 4-6 Sep 1989). Order Number DE90001570. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The erase bands on CoNiCr/Cr longitudinal media with coercivities ranging from 176 to 1390 Oe have been studied using a two-frequency, triple-track profile method. In this method, the two side tracks are recorded at 10 kFCI and the central track ranges from 0 to 40 kFCI. The write and the erase widths are measured by the Bitter method. Media properties such as coercivity, coercivity squareness and remanence-thickness product are correlated with the total write width. It is shown that media with high coercivity squareness contribute to a reduction in the width of a side erase band. In addition, the magnetic structure of the triple-track profile has been characterized by high resolution Bitter patterns using scanning electron microscopy, which show domain structures within bit cells and along track edges. Finally, the relationship of the erase band to the magnetic structure is discussed. 7 refs., 4 figs.

4522 (NUREG–1378) **PLOTnFIT: A BASIC program for data plotting and curve fitting.** Schiffgens, J.O. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and Systems Technology. Oct 1989. 131p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A07/MF A01 - GPO - OSTI.

PLOTnFIT is a BASIC program to be used with an IBM or IBM-compatible personal computer (PC) for plotting and fitting curves to measured or observed data for both extrapolation and interpolation. It uses the Least Squares method to calculate the coefficients of nth degree polynomials (e.g., up to 10th degree) of Basis Functions so that each polynomial fits the data in a Least Squares sense, then plots the data and the polynomial that a user decides best represents them. PLOTnFIT is very versatile. It can be used to generate linear, semilog, and log-log graphs and can automatically scale the coordinate axes to suit the data. It can plot more than one data set on a graph (e.g., up to 8 data sets) and more data points than a user is likely to put on one graph (e.g., up to 225 points). 3 refs.

4523 (PB–89-871115/XAB) **Computer systems protection: Uninterruptible power supplies. January 1983-September 1989 (Citations from the Computer data base). Report for January**

1983-September 1989. National Technical Information Service, Springfield, VA (USA). Sep 1989. 147p. Available from NTISPC N01/MF N01.

Supersedes PB–88-851316.

This bibliography contains citations concerning equipment used to protect computer systems from electrical-power fluctuations and outages. Voltage regulators and back-up power supplies are evaluated. Surge suppressors as part of the uninterruptible power-supply system (UPS) are briefly mentioned; they are covered in depth in another bibliography. IEEE test results and general performance evaluations are included. UPS for large data centers and for minicomputers are discussed. Market forecasts are presented. (This updated bibliography contains 361 citations, 105 of which are new entries to the previous edition.)

4524 (RFP–4368) **Abstract for Zeiss editor presentation.** Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. [1989]. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP03533. (CONF-8910271–1-Vugraphs: North American Zeiss User's Group conference, Newport Beach, CA (USA), 14 Oct 1989). Order Number DE90002285. Available from NTIS, PC A03/MF A01 - OSTI.

This presentation is on editor enhancements to the Zeiss COMET software. Zeiss' present editor was determined to be inadequate to fulfill the programming needs at Rocky Flats. These enhancements have increased programmer productivity and have decreased part program run time by up to 10%.

4525 (RISO-M–2800) **HERMES-model for Denmark.** Moeller Andersen, F. Risoe National Lab., Roskilde (Denmark). Jun 1989. 159p. Order Number DE90718926. Available from NTIS (US Sales Only), PC A08/MF A01.

This report presents the first version of the Danish HERMES model which is a macro-economic model developed for the Commission of the European Communities to be used by the Commission for economic analyses and forecasts. Similar models are developed for the other EEC countries and in order to perform multinational studies the national models are interlinked into a multinational model. The model is a medium-term econometric model where special attention is given to analysing structural changes, capacity effects of investments and the energy-economy interactions. In the Danish model production is determined for 9 branches and the total private consumption is divided into 15 categories of consumer goods. Capacity effects of investments are attempted described by the introduction of a putty-clay production funtion and the energy-economy interactions are analysed by treating energy as a separate factor of production and as specific categories of consumer goods. Besides presenting the overall structure and the specific equations chosen for the first version of the Danish model the report gives an overview over the alternative specifications tested but rejected for the present version of the model. The report is concluded with an analysis of the model's ability to describe the past development and a few multiplicator analyses for central variables of the model. (author) 23 tabs., 3 ills., 55 refs.

4526 (SAIC–90003103) **System software for Soviet computers.** Wegner, P.; Nestor, J.; Schonberg, E.; Smoliar, S.; Weinberger, P.J.; Wiederhold, G.; Wolcott, P. Science Applications International Corp., McLean, VA (USA). Aug 1989. 212p. Available from OSTI; Science Applications International Corporation, 1710 Goodridge Drive, P.O. Box 1303, McLean, VA 22102.

This report examines the range and capability of system software available for use on Soviet computers, described in translated technical literature published primarily in the period 1984 to 1987. Seven subtopics were selected for study: programming languages, operating systems, networks, software engineering, software tools, database management systems, and artificial intelligence tools. The baseline for this study was the 1984 FASAC report Soviet Computer Science Research (here called the Hammer study) which documented a considerable gap between US and Soviet computer capabilities. This study is narrower than the Hammer study, excluding hardware and theory and focusing on software systems capability rather than conceptual research. The panel intended to evaluate not only system software of Soviet origin, but also system software developed in Eastern Europe for use with Soviet hardware, but found little or no evidence for this expected cooperative activity.

4527 (SAND–89-2533C) **Position of Sandia National Laboratories with respect to product definition standards.** Sandia National Labs., Albuquerque, NM (USA). 12 Oct 1989. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8910283–1: Forum on electronic product definition standards, Gaithersburg, MD (USA), 26 Oct 1989). Order Number DE90002832. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories, in conjunction with the Department of Energy Computer Integrated Manufacturing Program, supports the use of the Department of Energy Data Exchange Format (DOEDEF) subset of IGES (the Initial Graphics Exchange Specification) for exchanges of mechanical product definition data between dissimilar computer aided systems of various types. The background for this position is described here.

4528 (SOL–89-15) **Generalized quasi-variational inequality and implicit complementarity problems.** Yao, Jen-Chih. Stanford Univ., CA (USA). Systems Optimization Lab. Oct 1989. 51p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract FG03-87ER25028. DMS-8913089;N00014-89-J-1659. Order Number DE90003101. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A new problem called the generalized quasi-variational inequality problem is introduced. This new formulation extends all kinds of variational inequality problem formulations that have been introduced and enlarges the class of problems that can be approached by the variational inequality problem formulation. Existence results without convexity assumptions are established and topological properties of the solution set are investigated. A new problem called the generalized implicit complementarity problem is also introduced which generalizes all the complementarity problem formulations that have been introduced. Applications of generalized quasi-variational inequality and implicit complementarity problems are given. 43 refs.

4529 (SOL–89-16) **A basic theorem of complementarity for the generalized variational-like inequality problem: Technical report.** Yao, Jen-Chih. Stanford Univ., CA (USA). Dept. of Operations Research. Nov 1989. 21p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract FG03-87ER25028. DMS-8913089;N00014-89-J-1659. Order Number DE90003102. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this report, a basic theorem of complementarity is established for the generalized variational-like inequality problem introduced by Parida and Sen. Some existence results for both generalized variational inequality and complementarity problems are established by employing this basic theorem of complementarity. In particular, some sets of conditions that are normally satisfied by a nonsolvable generalized complementarity problem are investigated. 16 refs.

4530 (UCID–21796) **Interactive multidimensional data analysis and understanding.** Azevedo, S.G.; Grant, C.; Brase, J.; Fitch, J.P.; Miller, M. Lawrence Livermore National Lab., CA (USA). Aug 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90001794. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Our goal in FY 88 was to assemble and coordinate the software and hardware required to accurately and quickly process, display, and interpret multidimensional data. These capabilities are of fundamental scientific importance and can directly impact Laboratory and national defense programs. In this report, we describe our progress to these ends using new interactive display algorithms and novel computer architectures. We have demonstrated a significant impact on a variety of Laboratory programs and will be continuing this project under the name of Scientific Visualization in FY 89. 5 figs.

4531 (UCRL–99673-Rev.1) **PCP [Parallel C Preprocessor]: A parallel extension of C that is 99% fat free: Revision 1.** Brooks, E.D. III. Lawrence Livermore National Lab., CA (USA). 27 Sep 1989. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891149–10-Rev.1: Supercomputing '89 conference, Reno, NV (USA), 13-17 Nov 1989). Order Number DE90002813. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The fork-join model for parallel computation requires efficient compiler and hardware support if it is to be used for tightly coupled applications. Because of deficiencies in compiler and hardware support, most existing implementations of the fork-join model require relatively large grain parallelism if good efficiency is to be obtained. We present an alternative parallel programming paradigm called the split-join model. When nested concurrency is encountered in the split-join model the team of processors is disassociated into subteams which independently handle the separate sections of parallel code. The key advantage of the split-join model is that it can be efficiently implemented with a machine independent preprocessor and a small amount of machine dependent run time support. Extensive compiler and hardware support is not required. We describe the language constructs implemented in PCP and their efficient implementation. 11 refs.

4532 (WHC-SA–0726) **Computerized Adaptive Testing.** Bickerstaff, D.D.; Gardner, P.R. Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 13p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-87RL10930. (CONF-8910239–6: 13. annual TRADE conference, Baltimore, MD (USA), 22-25 Oct 1989). Order Number DE90001478. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Using exceedingly easy or difficult test items on a conventional fixed-length mastery test can result in a less-than-optimal measurement of achievement. Studies suggest that the use of variable-length adaptive tests may decrease the average test length, while improving the accuracy of the estimate of achievement. This paper presents an overview of criterion-referenced computerized adaptive testing and described an exploratory study at Westinghouse Hanford Company. 5 refs., 4 figs.

4533 **Variable loading roller.** Williams, D.M. To Dept. of Energy, Washington, DC. USA Patent 4,841,792. 27 Jun 1989. Filed date 21 Jan 1988. Int. Cl. F16H 13/14. 10p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an automatic loading roller for transmitting torque in traction drive devices in manipulator arm joints includes a two-part camming device having a first cam portion rotatable in place on a shaft by an input torque and a second cam portion coaxially rotatable and translatable having a rotating drive surface thereon for engaging the driven surface of an output roller with a resultant force proportional to the torque transmitted. Complementary helical grooves on the respective cam portions interconnected through ball bearings interacting with those grooves effect the rotation and translation of the second cam portion in response to rotation of the first.

4534 **Universal null DTE.** George, M.; Pierson, L.G.; Wilkins, M.E. To Dept. of Energy, Washington, DC. USA Patent 4,841,550. 20 Jun 1989. Filed date 9 Nov 1987. Int. Cl. H04L 7/00. 16p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a communication device in the form of data terminal equipment which permits two data communication equipments, each having its own master clock and operating at substantially the same nominal clock rate, to communicate with each other as a multi-segment circuit configuration of a general communication network even when phase or frequency errors exist between the two clocks. Data transmitted between communication equipments of two segments of the communication network is buffered. A variable buffer fill circuit is provided to fill the buffer to a selectable extent prior to initiation of data output clocking. Selection switches are provided to select the degree of buffer preload. A dynamic buffer fill circuit may be incorporated for automatically selecting the buffer fill level as a function of the difference in clock frequencies of the two equipments. Controllable alarm circuitry is provided for selectively generating an underflow or an overflow alarm to one or both of the communicating equipments.

9903 Information Handling

Refer also to citation(s) 2598, 3494, 3790, 4112, 4534

4535 (ANL/TM–474) **A plan for administrative computing at ANL, FY 1990 through FY 1992.** Caruthers, L.E. (ed.); Hale, D.O.; Bretscher, M.E.; Hischier, R.C.; Moore, N.J.; Slade, R.G. Argonne National Lab., IL (USA). Oct 1989. 139p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90002596. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

In July of 1988, Argonne National Laboratory management approved the restructuring of Computing Services into the Computing and Telecommunications Division, part of the Physical Research area of the Laboratory. One major responsibility of the Computing and Telecommunications Division is Management Information Systems. The Management Information Systems staff serve as consultants for administrative computing users Laboratory-wide. A significant aspect of Management Information Systems' work is the development of proposals for new and enhanced administrative computing systems based on an analysis of informational needs. This document represents the outcome of the planning process for FY 1990 through FY 1992. This document discusses the strategy and goals which are an important part of administrative data processing plans for the Laboratory. This paper also describes the management guidelines established by the Administrative Data Processing Oversight Committee for the proposal and implementation of administrative computing systems. The guidelines are a valuable tool for management in determining what applications would be appropriate to their needs and in formulating the proposals for those applications. Summaries of the proposals for new or enhanced administrative computing systems presented by individual divisions or departments with the assistance of Management Information Systems, to the Administrative Data Processing Oversight Committee is given. The summaries indicate some of the possibilities for the development of administrative computing systems at ANL. Detailed tables give information on how much the resources to develop and implement a given system will cost its users. The tables include development costs, computing/operations costs, software and hardware costs, and effort costs.

4536 (CONF-8911113–1) **Business communications.** Bratten, W.A.; Emrich, M.L. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. 1651-1567-A1. From Institute of Industrial Engineers conference; Atlanta, GA (USA); 14 Nov 1989. Order Number DE90002717. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Over the last few years, the need to communicate worldwide has produced positive results among standards bodies. This enabled differing factions to resolve conflicts among higher layer protocols. The European communities regulatory bodies will gain considerable flexibility with a uniform standard. At present X.400 stands ready to provide global business communication. 9 refs., 1 fig.

4537 (DOE/IG–0273) **Implementation of the land-based national telecommunications networks.** USDOE Office of Inspector General, Washington, DC (USA). Capital Regional Office. 10 Oct 1989. 7p. Sponsored by U.S. DOE Management & Administration. Available from OSTI.

Report to The Secretary.

The Department of Energy (DOE) is implementing a Nationwide Telecommunications Service called DOENTS. It is composed of both satellite and land-based networks. The satellite network was the subject of a previous report. This report addresses the land-based networks.

4538 **Database in Japan 1989.** 109p. Database Promotion Center, Tokoyo, Japan (1989).

This paper discusses the following topics: present situation of database services in Japan; trends of database in foreign countries; international development of databases; current state of in-house databases in Japan; utilization of database; local databases; new trends related to database; activities for promotion of database; and chronological table of database.

4539 (DPC–90003258) **Directory of Japanese databases in 1989.** Database Promotion Center, Tokyo (Japan). c 1989. 235p. Available from Database Promotion Center, Japan, 7th fl. World Trade Center Bldg. 2-4-1, Hamamatsu-cho Minato-ku, Tokyo, 105 Japan.

Commercial database services in Japan has been growing rapidly in recent years. This fact gives rise to demands for a guide to commercial databases usable in Japan for the users. To satisfy such demands, DATABASE PROMOTION CENTER, JAPAN has compiled and published the "Directory of Databases usable in Japan (in Japanese)" so that the user can easily find the information on the databases he or she requires, such as the name of the database, producer name, outline of the database, and service conditions. The "Directory of Databases usable in Japan" introduces databases not only made in Japan but also in other countries as long as they can be used in Japan. The 1989 edition of the Directory introduced 1964 databases of which 1436 were produced in foreign countries. In contrast, only about 100 of 528 databases of Japanese origin are serviced to the users abroad. It is important that what Japanese databases are available and how they should be used is introduced to the users abroad, apart from whether how to service Japanese databases to foreign countries. In response to this problem, we made an attempt to compile and publish the "Directory of Japanese Databases in 1989 (in English)" which is a translated version of Japanese databases out of the "Directory of Databases usable in Japan (in Japanese)". Lastly, we would like to hope this Directory will be a help for the foreign businessmen.

4540 (EGG-M–89437) **Environmental data qualification system.** Hester, O.V.; Groh, M.R. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891072–2: 27. Hanford symposium on health and the environment: multilevel research–molecules to man, Richland, WA (USA), 18-20 Oct 1989). Order Number DE90002030. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Integrated Environmental Data Management System (IEDMS) is a PC-based system that can support environmental investigations from their design stage and throughout the duration of the study. The system integrates data originating from the Sampling and Analysis Plan, field data and analytical findings. The IEDMS automated features include sampling guidance forms, barcoded sample labels and tags, field and analytical forms reproduction, sample tracking, analytical data qualification, completeness reports, and results and QC data reporting. The IEDMS has extensive automated capabilities that support a systematic and comprehensive process for performing quality assessment of EPA-CLP chemical analyses data. One product of this process is a unique and extremely useful tabular presentation of the data. One table contains the complete set of results and QC data included on the CLP data forms while presenting the information consistent with the chronology in which the analysis was performed. 3 refs., 1 fig.

4541 (LBL–24121) **Optimizing voting-type algorithms for replicated data.** Kumar, A.; Segev, A. Lawrence Berkeley Lab., CA (USA). Mar 1988. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8803245–1: International conference on extending database technology, Venice (Italy), 14-18 Mar 1988). Order Number DE90003118. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The main objectives of data replication are improved availability and reduced communications cost for queries. Maintaining the various copies consistent, however, increases the communications cost incurred by updates. For a given degree of replication, the choice of a specific concurrency control algorithm can have a significant impact on the total communications cost. In this paper we present various models for analyzing and understanding the trade-offs between the potentially opposing objectives of maximum resiliency and minimum communications cost in the context of the quorum consensus class of algorithms. It is argued that an optional vote assignment is one which meets given resiliency goals and yet incurs the least communications cost compared with all other alternative assignments. A mathematical model for vote assignment is developed, and optimal algorithms are presented. It is demonstrated that significant cost savings can be realized from these approaches. 14 refs., 1 fig., 2 tabs.

4542 (LBL–25337) **Abbreviated query interpretation in extended entity-relationship oriented databases.** Markowitz, V.M.; Shoshani, A. Lawrence Berkeley Lab., CA (USA). Aug 1989. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8910295–1: 8. international conference on entity-relationship approach, Toronto (Canada), 18-20 Oct 1989). Order Number DE90003114. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In order to express database queries, users are often required to understand large, complex database structures. It is important to relax this requirement by allowing users to express concise (abbreviated) queries, so that they can manage with partial, or even no knowledge of the database structure. Abbreviated queries involve only the specification of the objects that are relevant to the users. The main problem with abbreviated queries is to derive the corresponding full queries. In this paper we present a methodology to support the expression of abbreviated queries in Extended Entity-Relationship (EER) oriented relational databases, that is, relational databases whose schemas are translations of EER schemas. In EER-oriented databases, abbreviated queries can be represented by disconnected subgraphs of the corresponding EER diagrams. We propose a criterion for determining the connected subgraphs corresponding to such abbreviated queries. Our criterion is based on the robustness of the relational view corresponding to a connected subgraph of an EER diagram. View robustness expresses the capability of performing side-effect free updates via the view. We also investigate techniques that take advantage of specific properties of EER diagrams in order to reduce the complexity of finding the subgraphs that correspond to a given abbreviated query. 22 refs., 7 figs.

4543 (LBL–26600) **Event-join optimization in temporal relational databases.** Segev, A.; Gunadhi, H. Lawrence Berkeley Lab., CA (USA). Jan 1989. 32p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8908116–2: 15. international conference on very large data bases, Amsterdam (Netherlands), 22-25 Aug 1989). Order Number DE90003117. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An Event-Join is mostly used to group several temporal attributes of an entity into a single relation. It combines temporal equi-join components into one operation. The temporal outerjoin component is different than a non-temporal outer-join operations. In this paper, we motivate the need to support the efficient processing of event-joins, and introduce several optimization algorithms, both for a general data organization and for specialized organizations (sorted and append-only databases). For the append-only database we introduce a new data structure, that can improve the performance of event-joins as well as other queries. Finally, we evaluate the performance of the proposed algorithms. 24 refs., 7 figs., 5 tabs.

4544 (NUKEM-FuE–88041) **Corrosion database for the nuclear fuel cycle. Sub-project no. 1. Final report.** Schoenfeld, R.; Wegner, K. Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Mar 1989. 98p. (In German). Grant BMFT KWA 16128. Order Number DE90722011. Available from NTIS (US Sales Only), PC A05/MF A01.

The aim of the project was to prepare and process data on corrosion in fuel recycling systems of fast breeder reactors and to store them in a test data base designed as an information system. Based on examinations on the nitric acid corrosion of austenitic steels (typical material/corrosive agent combination used in the reprocessing of burned fuel elements of nuclear power plants) and, in coordination with scientist specialized on materials, the most important characteristics were determined and summarized in a catalogue. This catalogue was realized with the help of a relational data base management system as a scientific data base where the adequate information from the original literature is recorded. (orig./MM).

4545 (SOL–89-7) **Sequential quadratic programming algorithms for optimization.** Prieto, F.J. Stanford Univ., CA (USA). Systems Optimization Lab. Aug 1989. 158p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation; Spain. DOE Contract FG03-87ER25030. N00014-87-K-0142;ECS-8715153. Order Number DE90000022. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The problem considered is that of finding local minimizers for a function subject to general nonlinear inequality constraints, when first and perhaps second derivatives are available. The methods studied belong to the class of sequential quadratic programming

(SQP) algorithms. In particular, the methods are based on the SQP algorithm embodied in the code NPSOL, which was developed at the Systems Optimization Laboratory, Stanford University. The goal of this paper is to develop SQP algorithms that allow some flexibility in their design. Specifically, we are interested in introducing modifications that enable the algorithms to solve large-scale problems efficiently. The following issues are considered in detail: instead of trying to obtain the search direction as a minimizer for the QP, the solution process is terminated after a limited number of iterations. Suitable termination criteria are defined that ensure convergence for an algorithm that uses a quasi-Newton approximation for the full Hessian. For many problems the reduced Hessian is considerably smaller than the full Hessian. Consequently, there are considerable practical benefits to be gained by only requiring an approximation to the reduced Hessian. Theorems are proved concerning the convergence and rate of convergence for an algorithm that uses a quasi-Newton approximation for the reduced Hessian when early termination of the QP subproblem is enforced. The use of second derivatives, while having significant practical advantages, introduces new difficulties; for example, the QP subproblems may be nonconvex, and even a minimizer for the subproblem is no longer guaranteed to yield a suitable search direction. Also, theorems are proved for the convergence and rate of convergence of these algorithms. Finally, some numerical results, obtained from a modification of the code NPSOL, are presented. 43 refs., 4 tabs.

4546 (SOL–89-11) **On the identification of local minimizers in inertia-controlling methods for quadratic programming.** Forsgren, A.L.; Gill, P.E.; Murray, W. Stanford Univ., CA (USA). Systems Optimization Lab. Jul 1989. 24p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; Goeran Gustafsson Foundation; National Science Foundation. DOE Contract FG03-87ER25030. CCR-8413211;N00014-87-K-0142. Order Number DE89017330. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The verification of a local minimizer of a general (i.e., nonconvex) quadratic program is in general an NP-hard problem. The difficulty concerns the optimality of certain points (which we call dead points) at which the first-order necessary conditions for optimality are satisfied, but strict complementarity does not hold. One important class of methods for solving general quadratic programming problems are called inertia-controlling quadratic programming (ICQP) methods. We derive a computational scheme for proceeding at a dead point that is appropriate for a general ICQP method. 13 refs.

4547 (SOL–89-12) **A modified Newton method for unconstrained minimization.** Forsgren, A.L.; Gill, P.E.; Murray, W. Stanford Univ., CA (USA). Systems Optimization Lab. Jul 1989. 37p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; Goeran Gustafsson Foundation; National Science Foundation; Swedish National Board for Technical Development. DOE Contract FG03-87ER25030. ECS-8715153;N00014-87-K-0142. Order Number DE89017331. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Newton's method has proved to be a very efficient method for solving strictly convex unconstrained minimization problems. For the nonconvex case, various modified Newton methods have been proposed. In this paper, a new modified Newton method is presented. The method is a linesearch method, utilizing the Cholesky factorization of a positive-definite portion of the Hessian matrix. The search direction is defined as a linear combination of a descent direction and a direction of negative curvature. Theoretical properties of the method are established and its behaviour is studied when applied to a set of test problems. 27 refs., 6 figs., 4 tabs.

4548 (SOL–89-14) **A class of "onto" multifunctions.** Eaves, B.C.; Rothblum, U.G. Stanford Univ., CA (USA). Systems Optimization Lab. Sep 1989. 19p. Sponsored by U.S. DOE Energy Research; National Science Foundation; United States-Israel Binational Science Foundation. DOE Contract FG03-87ER25028. Order Number DE90002651. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A convex valued, upper continuous multifunction with a pointed closed convex domain is proved to be onto, if there is a selection with certain coercive properties and if the selection for each point lies in the affine hull of the smallest face of the domain containing the point. The proof uses a piecewise affine homotopy construction. 9 refs., 2 figs.

4549 **One-way transformation of information.** Cooper, J.A. To Dept. of Energy, Washington, DC. USA Patent 4,841,570. 27 Jun 1989. Filed date 11 May 1987. Int. Cl. H04K 1/00. 18p. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method and apparatus are provided for one-way transformation of data according to multiplication and/or exponentiation modulo a prime number. An implementation of the invention permits the one way residue transformation, useful in encryption and similar applications, to be implemented by n-bit computers substantially with no increase in difficulty or complexity over a natural transformation thereby, using a modulus which is a power of two.

9904 Law

Refer also to citation(s) 2497

9905 Civilian Defense

Refer also to citation(s) 2802, 3379

4550 (AD-A–210462/8/XAB) **Volunteering for emergency preparedness. Final report, March 1988-March 1989.** Nehnevajsa, J. Pittsburgh Univ., PA (USA). Univ. Center for Social and Urban Research. May 1989. 104p. Available from NTIS, PC A06/MF A01.

This nation-wide quantitative telephone survey predicts levels of voluntary activity for emergency and disaster preparedness. The study involved a random national phone sample of 1,595 respondents in the 48 contiguous states. Actual voluntary activity performed during or immediately following an emergency or disaster is not explicitly considered in the research. Rather, this study attempts to measure willingness to volunteer and willingness to participate in training programs. Training programs are conceptualized to mean both education and practice. The study also includes rating schedules - poor to excellent - for attitudes toward the self-help concept and perceived effectiveness of local and Federal government emergency and disaster programs. While the self-help concept rating is considered as a variable in its own right, evaluation consists of its relation to the following variables: prior volunteer experience, the expressed willingness to volunteer, and the perceived effectiveness of each local and Federal government programs. Indices are computed for the perceived effectiveness of government programs, and compared with percentages that reflect respondents ratings of the self-help concept, as well as prior and expressed willingness for volunteering and training activities. Patterns of participation in training and volunteering are also examined.

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in *DOE Energy Data Base: Corporate Author Entries* (DOE/TIC-4585). Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, also abbreviated; and (3) the language of the document if non-English (R;US;In French). Author affiliations are not listed in this index.

A

Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik
Applications of structural systems reliability theory in offshore engineering. State-of-the-art, 15:3255 (R;DK)

Academia de Ciencias do Estado de Sao Paulo, SP (Brazil)
Analysis by X-ray diffraction of new esquiatosomicides, 15:4222 (R;BR;In Portuguese)

ACEC Research and Management Foundation, Washington, DC (USA)
Commercial building research workshop. July 30-31, 1986, 15:2145 (R;US)

Acres International Corp., Amherst, NY (USA)
Testing of indoor radon-reduction techniques in central Ohio houses: Phase 1 (Winter 1987-1988). Report for October 1987-August 1988 (Final), 15:3485 (R;US)

Acurex Corp., Research Triangle Park, NC (USA)
Bench-scale evaluation of calcium sorbents for acid-gas emission control. Report for October 1988-March 1989, 15:3444 (R;US)
Calcination of calcium hydroxide sorbent in the presence of SO_2 and its effect on reactivity. Report for October 1988-March 1989, 15:3443 (R;US)
Mobile air-conditioner refrigerant evaluation. Report for April 1988-March 1989, 15:3441 (R;US)

Acurex Corp., Research Triangle Park, NC (USA). Environmental Systems Div.
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 5, July 1–September 30, 1989, 15:2424 (R;US)

Adiabatics, Inc., Columbus, IN (USA)
Coal-fueled diesel systems research: Volume 2, Engine operation, durability and economic: Final report, 15:2799 (R;US)

Advisory Group for Aerospace Research and Development (AGARD), 92 - Neuilly-sur-Seine (France)
Survey of measurements and measuring techniques in rapidly distorted compressible turbulent boundary layers, 15:3185 (R;FR)

AeroChem Research Labs., Princeton, NJ (USA)
Enhanced flame stability and soot radiation using electric fields. Final report, July 1986-January 1989, 15:3114 (R;US)

Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.
Coupled multiline c-w (continuous-wave) HF (hydrogen fluoride) lasers: Experimental performance. Technical report, 15:3149 (R;US)
Multiline multimode c-w (continuous-wave) chemical laser performance. Technical report, 15:3142 (R;US)

Aerospace Corp., El Segundo, CA (USA). Electronics Research Lab.
Bias and oxide thickness dependence of trapped-charge buildup in MOS (metal oxide semiconductors) devices. Technical report, 15:3222 (R;US)
High-energy-neutron irradiation effects in GaAs modulation-doped field effect transistors (MODFETs): Threshold voltage. Technical report, 15:3360 (R;US)

Aerospace Corp., El Segundo, CA (USA). Laboratory Operations
Auroral energy deposition over the polar ionosphere during substorms. Technical report, 15:3882 (R;US)
Dissociation and vibrational relaxation of XeF by various collision partners, 15:3146 (R;US)

AeroVironment, Inc., Monrovia, CA (USA)
Computer simulation of wind/diesel system operation, 15:2383 (R;US)

Aidt Miljoe, Hadsten (Denmark)
Development of solar collector modules, 15:2347 (R;DK;In Danish)

Air Force Astronautics Lab., Edwards AFB, CA (USA)
Potential for a near-term very-low-energy antiproton source at Brookhaven Bational Laboratory. Special report, 15:3947 (R;US)

Air Force Geophysics Lab., Hanscom AFB, MA (USA)
Assessment of global atmospheric effects of a major nuclear conflict. Final report, 1 February 1984-31 May 1987, 15:3474 (R;US)
Space radiation environment at 840 km, 15:3881 (R;US)

Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering
Analysis of fallout prediction codes including the Fallout Assessment system (FAS). Master's thesis, 15:3383 (R;US)

Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA)
Compliance testing of the Eglin AFB (Air Force Base) asphalt-concrete Batch Plant, Eglin AFB, Florida. Final report, 5-11 March 1989, 15:3403 (R;US)
Waste-water characterization survey, Little Rock AFB, Arizona. Final report, 11-24 July 1988, 15:3577 (R;US)

Air Force Weapons Lab., Kirtland AFB, NM (USA)
Experimental study of microwave transmission through a decaying plasma. Final report, January 1986-February 1988, 15:3936 (R;US)

Air Products and Chemicals, Inc., Allentown, PA (USA)
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 2, 15:2262 (R;US)
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 4, 15:2263 (R;US)
Slurry reactor hydrodynamics studies: Final report, 15:2261 (R;US)

Aix-Marseille-1 Univ., 13 - Marseille (France)
Jet instabilities in liquid-liquid systems. Application to direct contact heat exchangers, 15:3188 (R;FR;In French)

Aix-Marseille-2 Univ., 13 - Marseille (France)
Magnetic microtearing coherence in tokamak plasmas, 15:4311 (R;FR;In French)

Alabama A and M Univ., Normal, AL (USA)
Laser diagnostics of mineral matter and combustion processes in coal: Research report, September 1, 1988–January 31, 1989, 15:2097 (R;US)

Alabama Univ., University, AL (USA). Mineral Resources Inst.
Beneficiation-hydroretort processing of US oil shales, Volume 1: Final report, 15:2155 (R;US)

Alaska Univ., Fairbanks, AK (USA). Geophysical Inst.
Solar diurnal variation in the amplitude of sudden commencements of magnetic storms at the geomagnetic equator, 15:3885 (R;US)

Alaska Univ., Fairbanks, AK (USA). Petroleum Development Lab.
Development of a reservoir simulation for thermal recovery of heavy oils/tar sands in the presence of gas hydrates: Final report, 15:2156 (R;US)

Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee
Proceedings of the conference: reclamation, a global perspective, 15:2079 (R;CA)

Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada)
Alberta/Canada Energy Resources Fund annual review, 1987-88, 15:2603 (R;CA;In English and French)
Alliance Technologies Corp., Chapel Hill, NC (USA)
Source characterization and control technology assessment of methylene chloride emissions from Eastman Kodak Company, Rochester, NY. Final report, July 1988-April 1989, 15:3452 (R;US)
US and Canadian emissions inventory, 1985. Report for March-September 1988, 15:3442 (R;US)
Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.
High-temperature gel-permeation chromatography of poly(4-methyl-1-pentene), 15:3063 (R;US)
American Coll. of Radiology, Chicago, IL (USA)
Technique for chest radiography for pneumoconiosis, 15:3678 (R;US)
American Council for an Energy-Efficient Economy, Washington, DC (USA)
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 7, Community and local government conservation programs, 15:2620 (R;US)
American Inst. of Physics, New York, NY (USA)
Quantum fluids and solids, 1989, 15:3938 (B;US)
Analytical Sciences, Inc., Research Triangle Park, NC (USA)
Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989, 15:3460 (R;US)
Andrija Stampar School of Public Health, Zagreb (Yugoslavia). Dept. of Occupational Health
Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)
Arbeitsgemeinschaft fuer die Reinhaltung der Elbe der Laender Hamburg, Niedersachsen und Schleswig-Holstein, Hamburg (Germany, F.R.)
Water quality criteria and management models for the tidal region of the Elbe-River, 15:3566 (R;DE;In German)
Argonne National Lab., Idaho Falls, ID (USA)
Faster-than-real-time simulation for plant control, 15:2478 (R;US)
Preparing a self-evaluation report for training program accreditation, 15:2460 (R;US)
Argonne National Lab., IL (USA)
1988 interorganizational workshop on future utility SO_2 emissions, 15:2078 (R;US)
A collaborative effort to model plant response to acidic rain, 15:3404 (R;US)
A comparison result and elliptic equations involving subcritical exponents, 15:4510 (R;US)
A plan for administrative computing at ANL, FY 1990 through FY 1992, 15:4535 (R;US)
Advanced research in instrumentation and control technology, 15:2053 (R;US)
Advancements in the behavioral modeling of fuel elements and related structures, 15:2504 (R;US)
An assessment and comparison of fuel cells for transportation applications, 15:2794 (R;US)
Analysis of fluid-structure interaction and structural response of Chernobyl-4 reactor, 15:2503 (R;US)
Anisotropy of oxygen tracer diffusion in $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:2914 (R;US)
Application of neutron diffraction NDE to high-temperature superconducting composites, 15:3213 (R;US)
Atomic matching across internal interfaces, 15:4207 (R;US)
B production in hadron collisions: Theory, 15:3973 (R;US)
Biocrude suitability for petroleum refineries, 15:2269 (R;US)
Calorimetric measurements on electrochemical cells with Pd-D cathodes, 15:2575 (R;US)
Cavitation-controlled ultrasonic agitator, 15:3366 (R;US)
Characterization of nanophase materials by x-ray diffraction and computer simulation, 15:4206 (R;US)
Chemical cleaning of aluminum alloy surfaces for use as vacuum materials in synchrotron light sources, 15:2818 (R;US)
Combined NO_x/SO_2 control technology, 15:2421 (R;US)
Community relations programs: Improved planning through better understanding of communication systems, 15:2592 (R;US)
Comparison of the production and phenotypic properties of altered hepatocyte foci in rats initiated with diethylnitrosamine neonatally or after partial hepatectomy in early adulthood, 15:3599 (R;US)
Compromise prior on the basis of maximum entropy, 15:4261 (R;US)
Computation of electromagnetic effects in a tokamak due to a plasma disruption, 15:4303 (R;US)
Conversion feasibility studies for the Grenoble high flux reactor, 15:2458 (R;US)
Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)
Creep of chromia and yttria-doped chromia, 15:2902 (R;US)
Critical time step estimation for three-dimensional explicit impact analysis, 15:2508 (R;US)
Crystalline beams, 15:3316 (R;US)
Demonstration of a computer model for residual radioactive material guidelines, RESRAD, 15:2183 (R;US)
Dislocation-hydrogen correlation in metals, 15:4203 (R;US)
Dynamic simulation of mixed quantum-classical systems, 15:4208 (R;US)
Effectiveness of interim remedial actions at a radioactive waste facility, 15:2180 (R;US)
Elastic softening in nanocrystalline silicon, 15:2821 (R;US)
Electrode development in monolithic solid oxide fuel cells, 15:2654 (R;US)
Embrittlement of cast stainless steels in LWR systems, 15:2513 (R;US)
Embrittlement of laboratory- and reactor-aged CF-3, CF-8, and CF-8M duplex stainless steels, 15:2825 (R;US)
Environmental quality and the shift to alternative fuels: Progress and interim findings of a Department of Energy study of transition in vehicular power systems, 15:3407 (R;US)
Evaluation of fuel cell technologies for electric utility applications, 15:2758 (R;US)
Expert system applications in support of system diagnostics and prognostics at EBR-II, 15:2505 (R;US)
Fermi surface and effective masses for the heavy-electron superconductor UPt_3, 15:4248 (R;US)
Fermi surfaces by positron annihilation in $YBa_2Cu_3O_x$, 15:4255 (R;US)
Fission energy: The integral fast reactor, 15:2509 (R;US)
Fluid/particle separation and coal cleaning: Progress, potential advances, and their effects on FGD [flue-gas desulfurization], 15:2420 (R;US)
Fragmentation of high-spin particle-hole states in ^{26}Mg, 15:4081 (R;US)
Gas content in sealed Argonne Premium Coal Samples, 15:2051 (R;US)
Hadron collider physics at Fermilab, 15:3260 (R;US)
IDEA—Interactive Decision Analysis: Users' guide and tutorial, 15:4505 (R;US)
Impact of technology applications to the management of low-level radioactive wastes, 15:2182 (R;US)
Induction and repair of DNA strand-breaks in Bacteroides fragilis, 15:3598 (R;US)
Induction of sister chromatid exchanges by direct and indirect chemical agents in a human teratoma cell line, 15:3608 (R;US)
Inherent controllability in modular ALMRs, 15:2507 (R;US)
Interactions of fast atomic and molecular ions with matter, 15:4210 (R;US)
Intercomparison of U-238 deposits employed for neutron fluence determination in neutron activation cross section measurements, 15:4111 (R;US)
Interfacial area in two-phase flow, 15:3187 (R;US)
Interfacial effects in monolithic solid oxide fuel cells, 15:2655 (R;US)
Interpretation of gamma-scanning data from the ORR demonstration elements, 15:2489 (R;US)
Irradiation embrittlement of the shippingport neutron shield tank, 15:2442 (R;US)
Is there a strange attractor in a fluidized bed?, 15:2094 (R;US)
Isotope labeling investigations in simulated coalification: A view of geological metamorphism, 15:2052 (R;US)

Linear electron-hole-electron pair model of high-temperature superconductivity in $La_{2-x}M_xCuO_4$ and $YBa_2Cu_3O_{7-y}$: 2, Dependence of the superconducting transition temperatures on pressure and on hole concentration, 15:4251 (R;US)
LMR design to facilitate control, 15:2500 (R;US)
Local atomic displacements in high T_c oxides studied by pulsed neutron scattering, 15:2905 (R;US)
Maximum entropy and equations of state for random cellular structures, 15:2969 (R;US)
Metal wastage analysis of carbon steel tubes in FBC environment, 15:2093 (R;US)
Nanophase materials assembled from atomic clusters, 15:2824 (R;US)
Nature of phonons, isotope effect, and superconductivity in $Ba_{1-x}K_xBiO_3$, 15:2910 (R;US)
Neutral pion photoproduction of the nucleon near threshold, 15:3977 (R;US)
Observation of superdeformation in ^{191}Hg, 15:4107 (R;US)
On the topic of single and multicomponent chemisorption isotherms, 15:2092 (R;US)
Opportunities and prospects for Maglev in North America, 15:2709 (R;US)
Overview of the advanced photon source, 15:3318 (R;US)
PCBs in humans: What we know and what we don't know, 15:3759 (R;US)
Pion distribution in the nucleon, 15:3975 (R;US)
Practical superconductor development for electrical power applications: Annual report for FY 1988, 15:2432 (R;US)
Quadrupole magnet for the APS [Advanced Photon Source] storage ring, 15:3317 (R;US)
Quasicrystals and grain boundaries, 15:2823 (R;US)
Rationale for the proposed standard for a generic package of elementary functions for Ada: Revision 1, 15:4504 (R;US)
Regional application of natural-gas-fired combined-cycle power generation, 15:2759 (R;US)
Safety aspects of the IFR pyroprocess fuel cycle, 15:2502 (R;US)
Safety aspects of the US advanced LMR [liquid metal reactor] design, 15:2501 (R;US)
SASSYS validation with the EBR-II shutdown heat removal tests, 15:2506 (R;US)
Search for supersymmetric particles at CDF, 15:3974 (R;US)
Sodium/sulfur post-test analysis at ANL, 15:2573 (R;US)
Solid lubrication of ceramic sufraces by IAD [ion-assisted deposition]-silver coatings for heat engine applications, 15:2906 (R;US)
Solubility and superconductivity in $RE(Ba_{2-x}RE_x)Cu_3O_{7+\delta}$ (RE = Nd, Sm, Eu, Gd, Dy), 15:4250 (R;US)
Standard molar enthalpies of formation and transition at 298.15 K and other thermodynamic properties of the crystalline and vitreous forms of arsenic sesquiselenide (As_2Se_3): Dissociation enthalpies of As-Se bonds, 15:2968 (R;US)
Status and results of ANL life evaluation of valve-regulated lead-acid load-leveling batteries, 15:2574 (R;US)
Status of high-density fuel plates fabrication: Final draft, 15:2164 (R;US)
Stopping power and energy loss cross section of a point charge penetrating through a dense medium of bound electrons, 15:4205 (R;US)
Strand: A practical parallel programming language, 15:4512 (R;US)
Supporting independent inventors, 15:2605 (R;US)
Surface magneto-optical studies of ultrathin ferromagnetic films, 15:2822 (R;US)
Synthesis conductivity, and X-ray photoelectron spectrum of $Bi_2Sr_2Cu_{7+x}$. A new ternary bismuth-oxide system exhibiting metallic conductivity, 15:4252 (R;US)
Technology transfer in hazardous waste management, 15:2185 (R;US)
The Breeding Blanket Interface (BBI) and the Tritium Systems Test Assembly (TSTA), 15:4393 (R;US)
The conversion of the 2 MW reactor at the Rhode Island Nuclear Science Center, 15:2488 (R;US)
The current status of two-dimensional electrophoresis in germ cell mutation research, 15:3365 (R;US)
The development of clean coal technology in the United States, 15:2013 (R;US)
The effect of composition and processing on high T_c superconductors containing bismuth, 15:2909 (R;US)
The effects of heavy metals on the scaling ability of $CaCO_3$ and $Mg(OH)_2$, 15:3041 (R;US)
The generation and control of hazardous waste in the Pacific Basin, 15:3497 (R;US)
The Hazardous Materials Information Exchange: An electronic bulletin board for the emergency response community, 15:3494 (R;US)
The interesting future of supercomputing, 15:4509 (R;US)
The modeling of wear in energy conversion and utilization technologies: Proceedings, 15:3214 (R;US)
The Pacific Basin Consortium: A new device for problems without borders, 15:3496 (R;US)
The possible occurrence of multi-phase behavior in the high T_c superconductor $YBa_2Cu_3O_x$, 15:4249 (R;US)
The problem of finding a strategy in control binary paramodulation, 15:4506 (R;US)
The role of the axial anomaly in determining spin-dependent parton distributions, 15:3972 (R;US)
The slowdown of 1989–90: Further evidence for the use of transportation sector indicators to predict GNP growth, 15:2591 (R;US)
Thermal hydraulic analysis of fuel reprocessing Argon Cell accidents in the demonstration integral fast reactor, 15:2459 (R;US)
Tunneling spectroscopy and the electron-phonon interaction in $Ba_{1-x}K_xBiO_3$, 15:4254 (R;US)
Uncontrolled hazardous waste site cleanup programs in the US: An overview, 15:3495 (R;US)
US Energy use: New technologies and policies in response to global warming, 15:3408 (R;US)
Variational theory of nuclear and neutron matter, 15:4124 (R;US)
Velocity distribution of laser photoionized neutrals ejected from methanol-dosed aluminium(111) by electron-stimulated desorption, 15:4209 (R;US)

Arizona Univ., Tucson, AZ (USA). Dept. of Soils, Water and Engineering
Soil physical properties at the Las Cruces trench site, 15:2218 (R;US)

Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)
Effect of gamma radiation on DNA methylation, 15:3690 (R;US)
Effects of iron particles on behavior and brain function: Initial studies, 15:3756 (R;US)
Enhanced acoustic startle responding in rats with radiation-induced hippocampal granule cell hypoplasia, 15:3692 (R;US)
Gamma-radiation affects active electrolyte transport by rabbit ileum. 2. Correlation of alanine and theophylline response with morphology, 15:3689 (R;US)
Radiation quality and rat motor performance, 15:3691 (R;US)

Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.
Electrothermal guns – a theoretical investigation of factors for optimal performance. Technical report, 15:2660 (R;US)
Modeling casualties in nuclear warfare. Final report, 15:3385 (R;US)
Radiation-transport calculations of a simple structure using the vehicle code system with 69-group cross sections and the Monte Carlo neutron and photon code. Final report, 15:4178 (R;US)

Army Command and General Staff Coll., Fort Leavenworth, KS (USA). School of Advanced Military Studies
Battlefield nuclear weapons and tactical gridlock in Europe, 15:3387 (R;US)

Army Construction Engineering Research Lab., Champaign, IL (USA)
Review of facility-technology options and their development status. Final report, 15:2604 (R;US)
Three-dimensional modeling of heat transfer from slab floors. Final report, 15:2661 (R;US)

Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Coastal Ecology Group
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Alewife and blueback herring, 15:3536 (R;US)

Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Brown rockfish, copper rockfish, and black rockfish, 15:3537 (R;US)

Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.
Formulation of water-quality models for streams, lakes, and reservoirs: Modeler's perspective. Final report, 15:3544 (R;US)
Sediment-water interactions and contaminants in Corps of Engineers reservoir projects. Final report, 15:3543 (R;US)

Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab.
Fracture-toughness testing of metal-matrix composites, 15:2966 (R;US)
Neutron-radiography system for field use. Final report, 15:3212 (R;US)
Strain aging in tungsten-heavy alloys. Final report, 15:2810 (R;US)
Y-Si-Al-O-N glass fibers. Final report, 15:2967 (R;US)

Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil)
Angular dependence of parallels plates ionization chambers for x radiation, 15:3337 (R;BR;In Portuguese)
Conection factors for clinical dosemeters used in dosimetry of large fields radiation, 15:3336 (R;BR;In Portuguese)
Development of a mathematical phantom for a child with 10 years age for internal dosimetry, 15:4189 (R;BR;In Portuguese)
Performance of special extremity dosemeters of BeO in fields of x and gamma radiation, 15:3335 (R;BR;In Portuguese)

Associacao Brasileira de Metais, Sao Paulo, SP (Brazil)
Scoria analysis by X-ray fluorescence with briquet, 15:4224 (R;BR;In Portuguese)

Associates in Rural Development, Inc., Burlington, VT (USA)
Jubba Environmental and Socio-economic Studies (JESS). Final report, 15:2282 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 1. Executive report. Final report, 15:2283 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 2. Environmental studies. Final report, 15:2284 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 3. Socio-economic studies. Final report, 15:2285 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 4. Bibliography. Final report, 15:2286 (R;US)

Astrosystems, Inc., Newark, DE (USA). Astropower Div.
High-efficiency silicon concentrator solar cells for use with prismatic covers, 15:2302 (R;US)

Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.
Deposition of cobalt on surface-treated stainless steel under PWR conditions, 15:2445 (R;US)

Auburn Univ., AL (USA)
Design of the Compact Auburn Torsatron: [Annual performance report], 15:4399 (R;US)

Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)
Dose limits, 15:4192 (R;AU)

B

Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.
In-situ measurements of coal ash deposit optical properties: Final report, September 11, 1987–September 30, 1989, 15:2096 (R;US)
Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4, 15:2547 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
Multiloop integral system test (MIST): Test Group 35, Noncondensibles and venting: Final report: Volume 7, 15:2549 (R;US)
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)

Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Div.
Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4, 15:2547 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
Multiloop integral system test (MIST): Test Group 35, Noncondensibles and venting: Final report: Volume 7, 15:2549 (R;US)
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)

Babcock and Wilcox Owners Group, Lynchburg, VA (USA)
Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4, 15:2547 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
Multiloop integral system test (MIST): Test Group 35, Noncondensibles and venting: Final report: Volume 7, 15:2549 (R;US)
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)

BASF A.G., Ludwigshafen am Rhein (Germany, F.R.)
Analysis, development and investigations into phase behaviour of surfactant systems for de-oiling high-salinitiy reservoirs with reference to the Bockstedt field of Wintershall AG. Final report, 15:2110 (R;DE;In German)

Battelle Columbus Div., Mount Pleasant, PA (USA)
1988 survey of residential-sector demand-side management programs: Final report, 15:2645 (R;US)

Battelle Columbus Div., OH (USA)
Development of short-term tests for evaluating plastic gas-piping materials. Annual report, January-December 1984, 15:2150 (R;US)
The TVA moving-manifold targeted-chlorination system: Second field demonstration: Final report, 15:2413 (R;US)

Battelle New England Marine Research Lab., Duxbury, MA (USA)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 1. Final executive summary, 15:2129 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2, 15:2130 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices, 15:2131 (R;US)

Battelle Pacific Northwest Lab., Richland, WA (USA)
The reaction of gaseous iodoethane with silver nitrate, 15:2166 (R;US)

Bayerische Landesanstalt fuer Wasserforschung, Muenchen (Germany, F.R.)
Accumulation of radionuclides in fish during specified normal operation of nuclear installations and after incidents. Annual report 1987, 15:3567 (R;DE;In German)

Baylor Univ., Houston, TX (USA). Inst. of Molecular Genetics
Mapping and ordered cloning of the human X chromosome: Progress report, November 1988–October 1989, 15:3603 (R;US)

Bell Telephone Labs., Inc., New York, NY (USA)
Silicon chemistry in interstellar clouds, 15:3866 (R;US)

Benjamin (J.R.) and Associates, Inc., Mountain View, CA (USA)
Lower-bound magnitude for probabilistic seismic hazard assessment: Final report, 15:2526 (R;US)

Berkeley Research Associates, Inc., CA (USA)
Theory for high gain, high power free electron lasers: Final report, 15:3166 (R;US)

Bhabha Atomic Research Centre, Bombay (India)
Environmental radiation levels in and around Kalpakkam during 1983-1987, 15:4183 (R;IN)
Evaluated phase diagrams of binary metal-tellurium systems of the D-block transition elements, 15:2811 (R;IN)
Fuel Chemistry Division annual progress report for 1986, 15:2163 (R;IN)
Natural background radiation and population dose distribution in India, 15:4190 (R;IN)

Progress report on nuclear data activities in India for the period from July 1987 to December 1988, 15:4062 (R;IN)
U, Th and K distributions inferred from regional geology and the terrestrial radiation profiles in India, 15:3505 (R;IN)

Black and Veatch, Kansas City, MO (USA)
FGD damper guidelines: Volume 2, Guidelines: Final report, 15:2071 (R;US)
FGD [flue gas desulfurization] damper guidelines: Volume 1, Fundamentals and survey results: Final report, 15:2070 (R;US)

Bochum Univ. (Germany, F.R.)
Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)

Boeing Advanced Systems Co., Seattle, WA (USA)
Compatibility of fuel-system components with high density fuel. Final report, April 1987-January 1989, 15:2781 (R;US)

Boeing Military Airplane Co., Seattle, WA (USA)
Engineering Assignment 5, E-4B surveillance methodology. Final report, 15:3386 (R;US)

Bonneville Power Administration, Portland, OR (USA)
Fan pressurization test results from the residential construction demonstration project: Cycle 1, 15:2666 (R;US)

Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires
Experimental and theoretical study of two center electron emission in 25-MeV/u Mo^{40+} + He collisions, 15:4071 (R;FR)
Search for characteristic times governing the emission of two particles from an excited nucleus, 15:4063 (R;FR)

Brigham Young Univ., Provo, UT (USA)
Determination of thermodynamic data for modeling corrosion: Volume 1, Sulfates (Revision 1): Final report, 15:2443 (R;US)
Determination of thermodynamic data for modeling corrosion: Final report, Volume 2: Chlorides and acetates, 15:2444 (R;US)

British Steel Corp., Rotherham (UK). Swinden Labs.
Flux degassing of aluminium swarf and dross. A demonstration [at Birmal Components Ltd (Warley), Sarginson Bros Ltd (Coventry) and Cookson Precision Castings Ltd (London)], 15:2726 (R;GB)

Brookhaven National Lab., Upton, NY (USA)
Amperometric biosensors for glucose, lactate, and glycolate based on oxidases and redox-modified siloxane polymers, 15:3600 (R;US)
Atomic mass measurements with radioactive beams and/or targets: Where to start, 15:3070 (R;US)
Comparison of photodesorption yields from aluminum stainless and Cu-plated beam tubes, 15:3285 (R;US)
Cyclotron targetry for production of short-lived positron emitters, 15:3102 (R;US)
Deformed proximity potential for heavy ion reactions, 15:4123 (R;US)
Development and Testing of a RETRAN/MINET composite code and application to the J.A. Fitzpatrick plant, 15:2496 (R;US)
Direct insertion of metal ions into tetrasulfonated phthalocyanine, 15:3071 (R;US)
FACE: A free-air facility for fumigation with gaseous air pollutants: Revision, 15:3405 (R;US)
Glancing angle x-ray studies of oxide films: Revision, 15:2903 (R;US)
High energy heavy ion collisions and the RHIC [Relativistic Heavy Ion Collider] project at Brookhaven, 15:3261 (R;US)
Infra-red synchrotron radiation measurements at Brookhaven, 15:3283 (R;US)
Interaction between thermophilic microorganisms and crude oils: Recent developments, 15:2107 (R;US)
Magnetic viscosity in Ni/Cu compositionally-modulated alloys, 15:2812 (R;US)
Mechanical design of SXLS [Superconducting X-ray Lithography Source] radio-frequency cavity, 15:3284 (R;US)
Neutron capture therapy for melanoma, 15:3615 (R;US)
Neutron-antineutron oscillations in nuclei, 15:4070 (R;US)
Phase separation of holes in antiferromagnets, 15:2904 (R;US)
Pretreatment and conditioning of storage ring vacuum systems, 15:3315 (R;US)
Radioactive materials released from nuclear power plants: Annual report, 1987, 15:2540 (R;US)
Summary of advanced LMR [Liquid Metal Reactor] evaluations: PRISM [Power Reactor Inherently Safe Module] and SAFR [Sodium Advanced Fast Reactor], 15:2546 (R;US)
Tensile and impact testing of an HFBR [High Flux Beam Reactor] control rod follower, 15:2457 (R;US)
The evolution of high energy accelerators, 15:3258 (R;US)
The formation of metal-oxygen species at low temperatures, 15:4253 (R;US)
The initial scientific program at the NSLS infrared beamline, 15:4204 (R;US)
Vacuum system design for a superconducting x-ray lithography light source, 15:3314 (R;US)
Vertical distribution of pollutants in the presence of convective storms, 15:3406 (R;US)

Brown Univ., Providence, RI (USA). Dept. of Community Health
Case-control study of bladder cancer in Massachusetts among populations receiving chlorinated and chloraminated drinking water, 15:3771 (R;US)

Building Research Establishment, Watford (UK)
Building management systems: user experiences, 15:2662 (R;GB)
Space and hot water heating: energy-efficiency in large gas-fired systems, 15:2663 (R;GB)

Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.)
Hydrogeological, geohydraulic and geothermal studies in projected final storage sites for radioactive waste. Pt. 3. Geothermal studies. Final Report, 15:2200 (R;DE;In German)

Bundesanstalt fuer Materialforschung und -pruefung, Berlin (Germany, F.R.)
Elastic-plastic fracture mechanics analysis of a pressure vessel with an axial outer surface flaw. Technical report, 15:2531 (R;DE;In German)

Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene
Ingestion of radiocesium and strontium-90 by self-suppliers and non-self-suppliers in the first year following the Chernobyl reactor accident. Data taken as a basis for derivation of secondary intervention reference levels, 15:3502 (R;DE;In German)

Bundesministerium des Innern, Bonn (Germany, F.R.)
Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report, 15:3506 (R;DE;In German)

Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)
Analysis, development and investigations into phase behaviour of surfactant systems for de-oiling high-salinitiy reservoirs with reference to the Bockstedt field of Wintershall AG. Final report, 15:2110 (R;DE;In German)
Corrosion database for the nuclear fuel cycle. Sub-project no. 1. Final report, 15:4544 (R;DE;In German)
Critical investigations and model development on countercurrent flow of gas and liquid in horizontal and vertical channels. Final report, 15:2530 (R;DE;In German)
Design and test of a MR-imager with superconducting magnet. Final report, 15:3624 (R;DE;In German)
Determination of compatibility conditions of the burner/boiler system of heating equipment with a view to energy conservation by means of optimum adjustment of components. Final report. Pt. 3. Investigations of pressure swings in the starting process in a burner/boiler system, 15:3235 (R;DE;In German)
Determination of the dependence of engine characteristics on the properties of alternative fuels, 15:2800 (R;DE;In German)
Development of a technique for dismantling geometric complicated and thick components of closed down nuclear power plants with the principle of arc-waterjet cutting. Final report, 15:2532 (R;DE;In German)
Development of methods for the evaluation and reduction of risk factors for the maintenance of nuclear power plants, 15:2435 (R;DE;In German)
Effects of acid and lime on mesofauna of forest soils in the laboratory and in the field. Final report, 15:3762 (R;DE;In German)

Elastic-plastic fracture mechanics analysis of a pressure vessel with an axial outer surface flaw. Technical report, 15:2531 (R;DE;In German)
Experimental analysis of the behavior of iodine in the event of hypothetical accidents - iodine partition coefficients (follow-on project). Final report, 15:2555 (R;DE;In German)
Hydrogeological, geohydraulic and geothermal studies in projected final storage sites for radioactive waste. Pt. 3. Geothermal studies. Final Report, 15:2200 (R;DE;In German)
Investigations on combined deposition of particulate and gaseous pollutants in a packed bed filter at high temperatures, 15:2730 (R;DE;In German)
Methanol fuel M 100. Study into boundary conditions and optimisation of constituents, 15:2785 (R;DE;In German)
Options and techniques for enhanced waste heat recovery in small- and medium-sized enterprises. A guideline, 15:2731 (R;DE;In German)
Photovoltaic energy conversion - research projects on solar energy use, 15:2293 (R;DE;In German)
Rationalization of aerobic-thermophilic stabilisation by means of raw sludge dehydration, 15:2760 (R;DE;In German)
Shaping of working conditions for handicapped persons according to results of human-engineering research in hardcoal mining - main phase. Final report, 15:2103 (R;DE;In German)
Studies of the ternary phase diagram U-Pu-O between 1000 and 2000deg C. Structural and physico-chemical properties of $Pu_xU_yO_z$ mixed oxides with a view to applications as fuel, 15:2919 (R;DE;In German)
The DESONOX flue gas purification process, 15:2427 (R;DE;In German)

Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)
Accumulation of radionuclides in fish during specified normal operation of nuclear installations and after incidents. Annual report 1987, 15:3567 (R;DE;In German)
Ingestion of radiocesium and strontium-90 by self-suppliers and non-self-suppliers in the first year following the Chernobyl reactor accident. Data taken as a basis for derivation of secondary intervention reference levels, 15:3502 (R;DE;In German)
Measures for reduction of severe accident consequences: Comprehensive evaluation of the results sponsored by the BMI, 15:2495 (R;DE;In German)

Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center
Column flotation of coal with fluorosurfactants: Final report, 15:2014 (R;US)

C

Cal-Tech Management Associates, Sacramento, CA (USA)
Turning off the tap: Strategies for hazardous waste minimization in the city of Los Angeles, 15:2776 (R;US)

California Energy Resources Conservation and Development Commission, Sacramento, CA (USA)
Quarterly oil report: First quarter, 1989, 15:2124 (R;US)

California State Air Resources Board, Sacramento, CA (USA). Stationary Source Div.
Information on substances for review as toxic air contaminants. Summary report, January 1984-February 1989 (Final), 15:3430 (R;US)

California Univ., Berkeley, CA (USA)
Frequency dependence of quasi-particle mixers, 15:3118 (R;US)
Inverse a-c Josephson effect at terahertz frequencies, 15:3119 (R;US)

California Univ., Berkeley, CA (USA). Dept. of Chemical Engineering
The influence of texture on steady foam flow in Berea sandstone, 15:2109 (R;US)

California Univ., Davis, CA (USA)
Effects of air pollutants on photosynthesis, vegetative growth, and development of grapevines in the San Joaquin Valley of California. Final report, February 1987-February 1989, 15:3445 (R;US)

California Univ., Irvine, CA (USA). Public Policy Research Organization
Pilot investigation of indoor-outdoor and personal PM10 (thoracic) and associated ionic compounds and mutagenic activity. Final report, February 1987-April 1989, 15:3447 (R;US)

California Univ., Los Angeles, CA (USA)
The TITAN Reversed-Field Pinch fusion reactor study: Collection of papers, 15:4443 (R;US)

California Univ., Riverside, CA (USA)
Plant senescence: Its biochemistry and physiology, 15:3601 (B;US)

California Univ., Riverside, CA (USA). Statewide Air Pollution Research Center
Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)
Maintain and operate California Air Resources Board field fumigation facility for experimental use. Final report, 17 December 1987-30 June 1989, 15:3435 (R;US)

California Univ., San Diego, La Jolla, CA (USA). Dept. of Electrical Engineering and Computer Sciences
Studies of high power density, pico-second rise-time light-activated semiconductor switch. Final report, 1 September 1987-31 December 1988, 15:3223 (R;US)

California Univ., Santa Barbara, CA (USA). Dept. of Biological Sciences
Characterization of year-round sensitivity of California's Montane Lakes to acidic deposition. Final report, October 1986-June 1989, 15:3552 (R;US)

California Univ., Santa Cruz, CA (USA). Inst. of Marine Sciences
Accumulation patterns of heavy metals and chlorinated hydrocarbons by sea otters, Enhydra lutris, in California. Final report, 15:3788 (R;US)

Calyxes Research and Development Corp., Albuquerque, NM (USA)
Final report on the investigation of water purification and waste concentration by the Vacuum Freezing Multiple Phase Transformation Process and its eutectic extension, September 1986-September 1987, 15:3572 (R;US)

Cambridge Univ. (UK)
Effect of twins on critical currents of high T_c superconductors. Interim report No 4, 15:3120 (R;GB)

Casazza, Schultz and Associates, Inc., Arlington, VA (USA)
Composite ceramic superconducting wires for electric-motor applications. Annual report No. 1, 30 June 1988-30 June 1989, 15:3117 (R;US)

Caterpillar, Inc., Peoria, IL (USA)
Caterpillar 3406 spark-ignited natural-gas-engine emissions on EPA (Environmental Protection Agency) heavy-duty transient test cycle. Topical report, March-December 1988, 15:2801 (R;US)

CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)
Dirac-Fock calculations in multi-harmonic-oscillator basis, 15:4507 (R;FR;In French)
Stress corrosion cracking of an uranium-6 weight per cent niobium in gaseous oxygen, nitrogen and hydrogen, 15:2814 (R;FR;In French)

CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)
Implosion symmetry and stability, 15:4386 (R;FR)
Soft X-Ray amplification in laser plasmas, 15:4300 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete
International cooperation for operating safety, 15:2497 (R;FR;In French)
Trend and pattern analysis of operational data through cooperation between OECD countries, 15:2498 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Chimie Appliquee et d'Etudes Analytiques
Stress corrosion cracking of nickel base alloys characterization and prediction, 15:2813 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)
Optogalvanic spectroscopy in flames, 15:3040 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques
Electron beam diagnostics study, 15:3363 (R;FR;In French)
Parallel algorithms for solving the diffusion equation by finite elements methods and by nodal methods, 15:2470 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire
Electron beam diagnostics study, 15:3363 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires
Ionizing radiations dosimetry: new results in the megagray range, 15:4184 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique
Theoretical aspect of J/PSI production in nucleus-nucleus collisions, 15:3976 (R;FR)

Celgene Corp., Warren, NJ (USA)
Biological and biochemical methane reactions. Final report, March 1986-March 1989, 15:2268 (R;US)

Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.
Role of $Fe_xCr_{2-x}O_3$ standard solid solutions in the identification of rhombohedral phase composition by XRD, 15:2815 (R;GB)

Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.
Weld simulated US Mod 9Cr 1 Mo steel: Pt. 1. General microstructure, 15:2817 (R;GB)

Central Electricity Research Labs., Leatherhead (UK)
Ageing kinetics of CF3 cast stainless steel in the temperature range 300°C to 400°C, 15:2816 (R;GB)
Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)

Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.
Development of high-efficiency molten carbonate fuel cell. Evaluation of stack performance and clarification of degradation mechanism at high fuel utilization, 15:2656 (R;JP;In Japanese)

Centre Experimental de Recherches et d'Etudes du Batiment et de Travaux Publics, 75 - Paris (France)
Preliminary study to a demonstration building climatic design program in the Ivory Coast, 15:2664 (R;FR;In French)

Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil)
Bud irradiation to obtain resistence to citrus canker through induction of mutation, 15:3686 (R;BR;In Portuguese)

Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais
Spectroscopic analysis of orthonitrodiphenyl sulfide $C_{12}H_9NO_2S$, 15:4223 (R;BR;In Portuguese)

Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados
SU(4) proprerties of the Dirac equation, 15:4032 (R;BR)

CeramPhysics, Inc., Westerville, OH (USA)
Capacitive energy storage at cryogenic temperatures. Phase 2. Final report, 1 January 1986-31 December 1988, 15:2560 (R;US)

Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nukleami Mediciny a Radiacni Hygieny
Abstracts of 14th radiation hygiene days, 15:4191 (R;CS;In Czech, Slovak)

Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni
Abstracts of 14th radiation hygiene days, 15:4191 (R;CS;In Czech, Slovak)

Chalmers Inst. of Tech., Goeteborg (Sweden). Earth Heat Pump Group
Sunclay clay plant at Kungsbacka. Technical follow-up of the thermal storage, 15:2351 (R;SE;In Swedish)

Cincinnati Univ., OH (USA). Dept. of Civil and Environmental Engineering
Steam stripping and batch distillation for the removal/recovery of volatile organic compounds, 15:2736 (R;US)

Circuit Chemistry Corp., Maple Plain, MN (USA)
Recovery of metals using aluminum displacement, 15:2741 (R;US)

Clark Univ., Worcester, MA (USA)
Global trends and structural consequences of the proton-neutron interaction, 15:4125 (R;US)

Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire
Elementary analysis by means of the x fluorescence and energy dispersion, 15:3066 (R;FR;In French)
Study of the energetic proton production in relativistic heavy ions Ne + nuclei collisions, using Diogene detector. Hadronic matter temperature, 15:4068 (R;FR;In French)

Coast Guard, Washington, DC (USA). Office of Research and Development
Evaluation of fuel-cell technology for Coast Guard applications. Final report, 15:2653 (R;US)

Cohen (S.) and Associates, Inc., McLean, VA (USA)
Radiation-related impacts for nuclear plant physical modifications: Final report, 15:2543 (R;US)

Colloidal Contrete Corp., Golden, CO (USA)
Use of foaming mud cement to terminate underground coal fires and to control subsidence of burn cavities. Final report, 15:2091 (R;US)

Colorado School of Mines, Golden, CO (USA). Dept. of Chemical Engineering and Petroleum Refining
Process and analytical studies of enhanced low severity co-processing using selective coal pretreatment: Quarterly technical progress report, June–August, 1989, 15:2022 (R;US)

Colorado State Univ., Fort Collins, CO (USA)
Optimal real-time pump and irrigation scheduling for center-pivot sprinkler systems, 15:2724 (R;US)

Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab.
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of September and October 1989, 15:2332 (R;US)

Colorado Univ., Boulder, CO (USA)
Large signal nonlinear model of anisotropic transformers for nonsinusoidal operation: Final report, July 1, 1986–March 30, 1989, 15:3225 (R;US)

Colorado Univ., Boulder, CO (USA). Dept. of Chemistry and Biochemistry
Laser photoelectron spectroscopy of ions: Progress report, 1988–1989, 15:3095 (R;US)

Columbia Gas System Service Corp., Columbus, OH (USA)
Multizone completion opportunities in the Appalachian basin: Final report, 15:2138 (R;US)

Columbia Univ., New York, NY (USA)
Relativistic heavy ion research: Progress report, November 15, 1988–November 14, 1989, 15:4108 (R;US)

Columbia Univ., New York, NY (USA). Coll. of Physicians and Surgeons
Radiation physics, biophysics, and radiation biology: Progress report, December 1, 1988–November 30, 1989, 15:3694 (R;US)
The Radiological Research Accelerator Facility: Progress report, December 1, 1988–November 30, 1989, 15:3695 (R;US)

Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory
Transport and transfer rates in the waters of the continental shelf and slope: SEEP: Triennial report, 1 May 1987–30 April 1990, 15:3817 (R;US)

Combustion Engineering, Inc., Chattanooga, TN (USA)
Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil)
Evaluation of the utilization of neutron activation analysis for measuring non-irradiated nuclear fuels for safeguards, 15:2167 (R;BR;In Portuguese)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Normas e Especificacoes
Licesing of mining and milling facilities of uranium and/or thorium ores, 15:2248 (R;BR;In Portuguese)
Programs of meteorology in support of nuclear power plants, 15:3475 (R;BR;In Portuguese)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores
Determination of the protection set-points lines for the Angra-1 reactor core, 15:2441 (R;BR;In Portuguese)
Procedure to estimate radiation dose in the population in the case of an accident, 15:2499 (R;BR;In Portuguese)
Study of Angra I reactor core with inserted control rods, 15:3991 (R;BR;In Portuguese)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Lab. de Salvaguardas
Evaluation of the results from uranium chemical analysis by potentiometric tritation method for safeguards utilization through intercomparison programs, 15:3054 (R;BR;In Portuguese)

Commission of the European Communities, Abingdon (UK). JET Joint Undertaking
Model for calculating room air and surface tritium concentrations, 15:3480 (R;GB)

Commission of the European Communities, Brussels (Belgium). Directorate for Social Affairs
Investigation of explosion with delayed start (> 150 m) and methods of prevention. Final report, 15:2104 (R;DE;In German)

Commission of the European Communities, Luxembourg (Luxembourg)
Disposal in granite formations, 15:2197 (R;FR;In French)
Disposal in salt formations, 15:2198 (R;FR)
Disposal into the sub-seabed, 15:2199 (R;FR)
Performance assessment of geological isolation systems for radioactive waste. Disposal in clay formations, 15:2196 (R;FR)

Connecticut Univ., Storrs, CT (USA)
Proceedings of the Storrs meeting, 15:3942 (B;US)

Cool Water Coal Gasification Program, Daggett, CA (USA)
Cool Water Coal Gasification Program: Environmental Monitoring Plan. Volume 1-5, Section 1-12, Appendices A-F. Report for 1984-89, 15:2045 (R;US)
Cool Water Coal Gasification Program: Environmental monitoring plan. Final Report, non-proprietary. Executive summary. Report for 1984-1989, 15:2046 (R;US)

Cornell Univ., Ithaca, NY (USA)
Development and utilization of new diagnostics for dense-phase pneumatic transport: Quarterly technical progress report, July 1, 1989–September 30, 1989, 15:2084 (R;US)

Cornell Univ., Ithaca, NY (USA). Dept. of Natural Resources
Local government techniques for inland wetlands protection. Technical report, 15:3585 (R;US)

Cornell Univ., Ithaca, NY (USA). Lab. for Atomic and Solid State Physics
Dynamically compressed metals - theory. Final report, 1 February 1986-30 April 1989, 15:4200 (R;US)
Trajectory analysis of low-energy and hyperthermal ions scattered from Cu(110), 15:3887 (R;US)

Cowiconsult Raadgivende Ingenioerer A/S, Virum (Denmark)
District heating connections with high consumption, 15:2761 (R;DK;In Danish)

Crone og Koch Raadgivende Ingenioerfirma K/S, Viborg (Denmark)
Water hyacinth horticulture management of manure, 15:2735 (R;DK;In Danish)

D

Danish Electricity Supply Undertakings, Lyngby (Denmark)
Danish electricity supply. Statistics 1987., 15:2642 (B;DK;In Danish)

Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afdelingen for Fluid Mekanik
Joint action on aerodynamics of wind turbines, 15:2365 (R;DK)
Joint action on aerodynamics of wind turbines. Supplement, 15:2379 (R;DK)

Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Kemiteknik
Hydrogen chloride bonding on dry limestone, 15:3419 (R;DK;In Danish)
Measurements of gas concentrations and temperature in a boiler room, 15:2428 (R;DK;In Danish)

Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varme- og Klimateknik
Development of a data-processing model for steady turbulent 3-D gas particle flow, 15:3110 (R;DK;In Danish, English)

Danmarks Tekniske Hoejskole, Lyngby (Denmark). Lab. for Varmeisolering
Pilot project for a larger solar heating system with seasonal heat storage. Further documentation of borehole storage yield and economy, 15:2352 (R;DK;In Danish)
Plastic foil absorbers for solar collectors, 15:2345 (R;DK;In Danish)
Resource saving cassette building system for low energy houses, 15:2674 (R;DK;In Danish)

Database Promotion Center, Tokyo (Japan)
Database in Japan 1989, 15:4538 (B;JP)
Directory of Japanese databases in 1989, 15:4539 (R;JP)

DataMetrics Ltd., Calgary, AB (Canada)
Canadian natural gas: Export potential, 15:2144 (R;CA)

Delaurenti (Jordan), Inc., Dallas, TX (USA)
The effective supervision seminar the management development seminar: Final project report, 15:4490 (R;US)

Delaware Univ., Newark, DE (USA). Dept. of Chemical Engineering
Loss minimization through recombination center identification, 15:2301 (R;US)

Delmarva Power and Light Co., Wilmington, DE (USA)
Use of ash in highway construction: Delaware demonstration project: Final report, 15:2069 (R;US)

Denver Univ., CO (USA). Dept. of Physics
Investigation of fracture toughness and fracture mechanisms using acoustic emission measurements: Progress report, 1 March 1989–28 February 1990, 15:2829 (R;US)

Department of Energy, London (UK)
Adaptive pitch control for power regulation of the MS-2 wind turbine, 15:2363 (R;GB)
Electricity producing renewable energy technologies common costing methodology. V. 2, 15:2647 (R;GB)
Small scale hydroelectric generation potential in the UK. V. 1, 15:2276 (R;GB)
WEG MS-2 stall-regulated rotor study, 15:2362 (R;GB)

Department of Energy, London (UK). Energy Efficiency Office
Condensing boilers, 15:2679 (R;GB)
Flux degassing of aluminium swarf and dross. A demonstration [at Birmal Components Ltd (Warley), Sarginson Bros Ltd (Coventry) and Cookson Precision Castings Ltd (London)], 15:2726 (R;GB)

Department of Energy, Mines and Resources, Ottawa, ON (Canada)
Synthetic fuels from coal-heavy oil mixtures. Phase 1. A survey of the work applicable to coal bitumen mixtures as synthetic fuels feedstock, 15:2027 (R;CA)

Department of Health and Human Services, Washington, DC (USA)
Antigen-specific composition and in-vivo methods for detecting and localizing an antigenic site and for radiotherapy, 15:3682 (P;US)

Department of the Environment, London (UK)
Gas velocity measurements in purged port posting systems, 15:3124 (R;GB)
Management of tritium wastes in the United Kingdom. A survey of present and future arisings, review of possible disposal options and areas where further R and D may be needed to develop a management strategy for the future, 15:2179 (R;GB)

Department of the Navy, Washington, DC (USA)
Niobium and niobium nitride contacts on semiconducting material, 15:3233 (P;US)
Process for single-crystal growth of high T(c) superconductors, 15:2965 (P;US)

Deutsche Forschungsgemeinschaft, Bonn (Germany, F.R.)
Flue gas denitrification processes using tissue filters. Final report, 15:2426 (R;DE;In German)

Deutsche Shell A.G., Hamburg (Germany, F.R.)
Methanol fuel M 100. Study into boundary conditions and optimisation of constituents, 15:2785 (R;DE;In German)

DK-Teknik, Soeborg (Denmark)
Noise from larger windmills. Principles for the construction of windmills that produce less noise, 15:2380 (R;DK;In Danish)

Dortmund Univ. (Germany, F.R.). Lehrstuhl fuer Technische Chemie B
Desulfurization of industrial gaseous effluents. Final report, 15:2729 (R;DE;In German)

Drexel Univ., Philadelphia, PA (USA). Environmental Studies Inst.
EPA (Environmental Protection Agency) programs and the regulation of carcinogens: Methods and philosophies. Technical report, 15:3786 (R;US)

DRI/McGraw-Hill Energy Service, Lexington, MA (USA)
Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988, 15:2418 (R;US)

E

EG and G Idaho, Inc., Idaho Falls, ID (USA)
A simplified battery discharge profile based upon the federal urban driving schedule, 15:2577 (R;US)
Aging evaluation of electrical circuits using the ECCAD [Electrical Circuit Characterization and Diagnostics] system, 15:2522 (R;US)
An approach for testing fuel-cell/battery hybrid power sources for bus applications, 15:2658 (R;US)
An overview of BWR Mark-I containment venting risk implications, 15:2542 (R;US)
Aspects of the Kalina technology applied to geothermal power production, 15:2354 (R;US)
Assessment of battery technologies for electric vehicles: Volume 1, 15:2576 (R;US)
Atmospheric detritiation system performance, 15:4406 (R;US)
Battery technology assessment and R and D plan, 15:2793 (R;US)
Biosorption of molybdenum and chromium, 15:3546 (R;US)
Characterization of electric vehicle velocity and power profiles using road test data, 15:2792 (R;US)
Comparison of digestion procedures used for the determination of boron in biological tissues by ICP-AES [inductively-coupled, plasma-atomic emission spectroscopy], 15:3609 (R;US)
Comparison of thermal and mechanical responses of the TMI-2 reactor vessel, 15:2524 (R;US)
Course A—Numerical modeling of two-phase flows for presentation at Ecole d'Ete d'Analyse Numerique, 15:2516 (R;US)
Critical safety function guidelines for experimental fusion facilities, 15:4405 (R;US)
Development of an aging evaluation and life extension program for the Advanced Test Reactor, 15:2521 (R;US)
Dissipation measurement in high T_c superconductors with electromagnetic probes, 15:2916 (R;US)
DOE modifications to the MAAP [Modular Accident Analysis Program] code: Volume 6, Core melt progression modeling and benchmarking WBS 3.4.8, 15:2515 (R;US)
Earthquake strong ground motion studies at the Idaho National Engineering Laboratory, 15:3807 (R;US)
Electric and hybrid vehicles: Technical background report for the DOE flexible and alternative fuels study, 15:2791 (R;US)
Environmental data qualification system, 15:4540 (R;US)
Experience with J testing of 304/308 stainless steel weldment, 15:2833 (R;US)
Field testing of a ceramic heat exchanger for heat recovery application, 15:2727 (R;US)
Fission product relocation and behavior in the TMI-2 reactor vessel, 15:2486 (R;US)
Geothermal direct use projects in the United States: Status and trends, 15:2357 (R;US)
Heat transfer in condensation of lithium vapors, 15:4404 (R;US)
Human factors evaluation of electroluminescent display #1, 15:3126 (R;US)
In-core thermal hydraulic and fission product calculations for severe fuel damage analyses, 15:2438 (R;US)
INEL [Idaho National Engineering Laboratory] support to modernization efforts at the Aberdeen Proving Ground, 15:4515 (R;US)
Just how much water is required to cool a molten core?, 15:2519 (R;US)
Low cross-section Mo-Nb thermocouples for nuclear application: The state-of-the-art, 15:2831 (R;US)
Membrane applications in the food industry: Survey and barriers, 15:2728 (R;US)
Model for measuring complex performance in an aviation environment, 15:3127 (R;US)
Modeling of thermal hydraulic behavior and fission product releases in degraded cores, 15:2517 (R;US)
National program plan for electric vehicle battery research and development: Technical plan, 15:2790 (R;US)
Neutronics design of the INEL [Idaho National Engineering Laboratory] facility for boron neutron capture therapy clinical trials, 15:2490 (R;US)
Noncontacting laser ultrasonic generation and detection at the surface of molten metal, 15:2834 (R;US)
Numerical comparisons between the pyrolysis mass spectra of twelve US coals and their relative solubility in microbial cultures or alkaline buffer, 15:2062 (R;US)
Process monitoring using optical ultrasonic wave detection, 15:2915 (R;US)
Quality Assurance in the removal and transport of the TMI-2 core, 15:2523 (R;US)
Relationships between natural weathering and lignite biosolubility or alkali solubility, 15:2063 (R;US)
Review of LOFT [Loss-of-Fluid Test] large break experiments: OECD LOFT project, 15:2551 (R;US)
Risk assessment and risk management for an experimental nuclear waste processing facility, 15:2193 (R;US)
Scale model test results for an inverted U-tube steam generator with comparisons to heat transfer correlations, 15:2518 (R;US)
Seismic design criteria at the Idaho National Engineering Laboratory (INEL), 15:3808 (R;US)
Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)
Simulations of local Nusselt number using an algebraic stress model (ASM) for turbulent flow in a square 180 degree bend, 15:3937 (R;US)
Siphon penstock installations at hydroelectric projects: A survey of design, construction and operating experience, 15:2277 (R;US)
Site characterization program at the radioactive waste management complex of the Idaho National Engineering Laboratory: Annual progress report: FY-1988, 15:2186 (R;US)
Solution bias in complex systems modeling, 15:4514 (R;US)
The biocorrosion of copper by biopolymers as examined in situ, in real time FT-IR/CIR/ATR in conjunction with pre and post XPS/AES, 15:2832 (R;US)
TMI-2 data qualification and data bases, 15:2520 (R;US)
Verification of the ORIGEN2 code analysis for the TMI-2 reactor core, 15:2485 (R;US)
Where to from here? Future applications of mental models of complex performance, 15:2480 (R;US)

EG and G Mound Applied Technologies, Miamisburg, OH (USA)
Simultaneous thermal analysis techniques for characterization of energetic materials, 15:3380 (R;US)

Electric Power Research Inst., Palo Alto, CA (USA)
1988 interorganizational workshop on future utility SO_2 emissions, 15:2078 (R;US)
1988 survey of residential-sector demand-side management programs: Final report, 15:2645 (R;US)
Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report, 15:2195 (R;US)
Deposition of cobalt on surface-treated stainless steel under PWR conditions, 15:2445 (R;US)
Determination of thermodynamic data for modeling corrosion: Volume 1, Sulfates (Revision 1): Final report, 15:2443 (R;US)
Determination of thermodynamic data for modeling corrosion: Final report, Volume 2: Chlorides and acetates, 15:2444 (R;US)
EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 2: Technical reference manual, 15:2425 (R;US)
FGD damper guidelines: Volume 2, Guidelines: Final report, 15:2071 (R;US)
FGD [flue gas desulfurization] damper guidelines: Volume 1, Fundamentals and survey results: Final report, 15:2070 (R;US)
Gas turbine blade life assessment and repair guide: Final report, 15:2414 (R;US)

Guidelines for the prevention of economizer inlet header cracking in fossil boilers: Final report, 15:2412 (R;US)
Hydrogen conference: Workshop proceedings, 15:2258 (R;US)
Knowledge-based system: Voltage and VAR [volt-ampere-reactive] dispatch: Final report, 15:2411 (R;US)
Lower-bound magnitude for probabilistic seismic hazard assessment: Final report, 15:2526 (R;US)
Model validation: Cooling-tower performance: Final report, 15:2415 (R;US)
Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4, 15:2547 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
Multiloop integral system test (MIST): Test Group 35, Noncondensibles and venting: Final report: Volume 7, 15:2549 (R;US)
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)
Operation and performance of commercial cool storage systems: Volume 1, 1987 cooling season, 15:2564 (R;US)
Operation and performance of commercial cool storage systems: Volume 2, 1988 cooling season and project summary, 15:2565 (R;US)
Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)
The TVA moving-manifold targeted-chlorination system: Second field demonstration: Final report, 15:2413 (R;US)
Use of ash in highway construction: Delaware demonstration project: Final report, 15:2069 (R;US)

Energetics, Inc., Columbia, MD (USA)
Membrane separation processes for liquid hydrocarbons and gases in the petrochemical industry: A technical case study, 15:2118 (R;US)

Energipolitisk Udvalg, Copenhagen (Denmark)
Report on the Ministry of Energy's statement regarding subsection 2 of section 12 of act number 293 of 10th June 1981, on the utilization of Denmark's subterranean committee on 26th October 1988, 15:2139 (R;DK;In Danish)

Energy and Environmental Research Corp., Irvine, CA (USA)
Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 7, December 1, 1988–February 28, 1989, 15:2422 (R;US)
Guide to oil waste-management alternatives for used oil, oily waste water, oily sludge, and other wastes resulting from the use of oil products. Final report, 15:2127 (R;US)

Energy Research Corp., Danbury, CT (USA)
Effects of coal-derived trace species on the performance of molten carbonate fuel cells: Topical report (Progress report No. 4), 15:2657 (R;US)

Energy Technology Support Unit, Harwell (UK)
Process integration initiative. A review of the process integration activities funded under the Energy Efficiency R and D programme, 15:2732 (R;GB)

Enertech Consultants, Campbell, CA (USA)
EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 2: Technical reference manual, 15:2425 (R;US)

Environmental Health Research and Testing, Inc., Research Triangle Park, NC (USA)
Application of a simple short-term bioassay for the identification of genotoxins from hazardous wastes, 15:3782 (R;US)

Environmental Management Support, Silver Spring, MD (USA)
Ground-water research: Technical-Assistance Directory, 15:3575 (R;US)

Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.
Programmer's guide to MOBILE4 (mobile source emission factor model). Technical report, 15:2797 (R;US)

Environmental Protection Agency, Boston, MA (USA). Region I
Supplemental risk-assessment guidance for the Superfund program. Part 1. Guidance for Public-Health Risk Assessments. Part 2. Guidance for ecological Risk Assessments. Draft report (Final), 15:3582 (R;US)

Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment
Analytical methods necessary to implement risk-based criteria for chemicals in municipal sludge, 15:2775 (R;US)
Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)

Environmental Protection Agency, Cincinnati, OH (USA). Risk Reduction Engineering Lab.
Asbestos-fiber reentrainment during vacuuming and wet cleaning of carpet at a captive research site, 15:3437 (R;US)
EPA's (Environmental Protection Agency's) approach to pollution prevention, 15:2595 (R;US)
Formation and control of non-trihalomethane by-products, 15:3556 (R;US)
Hybrid knowledge-based/algorithmic approach to the design of waste-treatment systems, 15:3234 (R;US)
Incinerability index: A measure of incinerator performance, 15:2743 (R;US)
Quantitative evaluation of air-filtration systems in use at asbestos abatement sites: Research in progress, 15:3256 (R;US)
Statistical evaluation of airborne asbestos measured before, during, and after abatement, 15:3438 (R;US)
Translating research into practice: The drinking-water industry, 15:3578 (R;US)
Waste-minimization insights for the polymer industry, 15:2742 (R;US)

Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab.
Structural properties for determining mechanisms of toxic action, 15:3778 (R;US)

Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility
Radiological survey of the Mare Island Naval Shipyard, Alameda Naval Air Station, and Hunters Point Shipyard, 15:3568 (R;US)
Radiological surveys of Naval facilities on Puget Sound. Final report, 15:3571 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.
Air toxics control situation room. Report for July 1988-March 1989, 15:3450 (R;US)
Application of radon reduction methods (revised), 15:3484 (R;US)
Destruction of volatile organic compounds using catalytic oxidation. Report for April 1987-December 1988, 15:3439 (R;US)
Recent developments of emission control technology in the United States for fossil fuel combustion sources, 15:3249 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Research and Exposure Assessment Lab.
Trial burns: methods perspective, 15:2763 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.
Comparison of 0600-0900 AM hydrocarbon compositions obtained from 29 cities, 15:3431 (R;US)
Integration of fluid modeling with complex-terrain field studies and model-development efforts, 15:3449 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.
Chronic exposure to ozone causes restrictive lung disease, 15:3781 (R;US)
Complex mixtures of urban air pollutants: Identification and comparative assessment of mutagenic and tumorigenic chemicals and emission sources, 15:3784 (R;US)
Detection of genetic hazards from environmental chemicals with plant test systems, 15:3776 (R;US)
Effects of atmospheric mix and toxic fumes on military performance, 15:3777 (R;US)
Electrophysiological systems for neurotoxicity field testing: PEARL II and alternatives, 15:3780 (R;US)
Estimating human-equivalent no observed adverse-effect levels for VOCs (volatile organic compounds) based on minimal knowledge of physiological parameters. Technical paper, 15:3783 (R;US)
Genetic activity profiles: Use in management of risk from genotoxic substances in the environment, 15:3766 (R;US)

Genetic-activity profiles and hazard assessment, 15:3768 (R;US)
Human-health studies of carbon monoxide (CO) under conditions of military weapons systems crewman exposures. Protocol 1: Formation of cohb. Final report, September 1982-March 1985, 15:3755 (R;US)
Mutagenicity of combustion emissions from a biomedical-waste incinerator, 15:3774 (R;US)
Pathophysiological and disease constraints on aerosol delivery, 15:3767 (R;US)
Use of bioassay methods to evaluate incinerator emissions, 15:3440 (R;US)
Use of genotoxic activity profiles in assessment of carcinogenesis and transmissible genetic effects, 15:3775 (R;US)
Utility of short-term tests for genetic toxicity, 15:3612 (R;US)

Environmental Protection Agency, Washington, DC (USA)
A perspective on human exposure to PCDDs and PCDFs emitted form municipal waste combustors, 15:3758 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Cooperative Environmental Management
Ground water protection efforts in four new england states. Technical report, 15:3588 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Emergency and Remedial Response
ROD (Record of Decision) annual report, FY 1988, 15:3590 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report, 15:3523 (R;US)
Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988, 15:3524 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988, 15:3526 (R;US)
Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report, 15:3527 (R;US)
Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report, 15:3528 (R;US)
Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988, 15:3529 (R;US)
Superfund Record of Decision (EPA Region 3): Croyden TCE Spill, PA. (First Remedial Action), December 1988, 15:3586 (R;US)
Superfund Record of Decision (EPA Region 5): Wausau Water Supply, WI. (First Remedial Action), December 1988, 15:3587 (R;US)
Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988, 15:3500 (R;US)
Superfund Record of Decision (EPA Region 2): Ciba-Geigy, NJ. (First Remedial Action), April 1989, 15:3530 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)
Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report, 15:3532 (R;US)
Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988, 15:3533 (R;US)
Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989, 15:3534 (R;US)
Superfund Record of Decision (EPA Region 3): Wildcat Landfill, DE. (Second Remedial Action), November 1988. Final report, 15:3535 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action, 15:3591 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Health and Environmental Assessment
Assessment of ecologic risks related to chemical exposure: Methods and strategies used in the United States, 15:3772 (R;US)
Methods used in the United States for the assessment and management of health risk due to chemicals, 15:3773 (R;US)

Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste
Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)
Methodology for developing best demonstrated available technology (BDAT) treatment standards, 15:2765 (R;US)
Response to capacity-related comments submitted on the Second Third proposed land disposal restrictions rule, 15:3520 (R;US)
Response to the Second Third wastes treatment standards: Related comments for the Second Third land-disposal restrictions proposed rule (Issue Numbers 1 through 12), 15:3519 (R;US)
Treatment technology background document, 15:2764 (R;US)

Envirosphere Co., Santa Ana, CA (USA)
Reduction of arsenic wastes in the electronics industry (application to study). Final report, 15:2748 (R;US)
Reduction of solvent wastes in the electronics industry. Waste reduction grant program. Final report, 15:2749 (R;US)

Escola de Comando e Estado-Maior do Exercito, Rio de Janeiro, RJ (Brazil)
Brazilian nuclear policy with respect to the public opinion, 15:2614 (R;BR;In Portuguese)

F

Faber (Phyllis M.), Mill Valley, CA (USA)
The ecology of riparian habitats of the southern California coastal region: A community profile, 15:3538 (R;US)

Fauske and Associates, Inc., Burr Ridge, IL (USA)
DOE modifications to the MAAP [Modular Accident Analysis Program] code: Volume 6, Core melt progression modeling and benchmarking WBS 3.4.8, 15:2515 (R;US)
In-core thermal hydraulic and fission product calculations for severe fuel damage analyses, 15:2438 (R;US)

Fermi National Accelerator Lab., Batavia, IL (USA)
Conceptual design report for a superconducting coil suitable for use in the large solenoid detector at the SSC [Superconducting Super Collider], 15:3333 (R;US)
Cosmic evolution of non-topological solitons, paper 1, 15:3849 (R;US)
New directions for QA in basic research: The Fermilab/DOE-CH experience, 15:4491 (R;US)
Proton linac for hospital-based fast neutron therapy and radioisotope production, 15:3619 (R;US)
Quantum groups, braiding matrices and coset models, 15:4034 (R;US)
Recent results from the CDF [Collider Detector at Fermilab] experiment at the Tevatron proton-antiproton collider, 15:3953 (R;US)
SSC [Superconducting Super Collider] supplementary conceptual design report: Cryogenics for detectors, 15:3288 (R;US)
Status of glueball mass calculations in lattice gauge theory, 15:3986 (R;US)
Structural performance of the first SSC [Superconducting Super Collider] Design B dipole magnet, 15:3287 (R;US)
Weighted fit of parametric functions to distributions: The new interface of HOBOOK with MINUIT, 15:4516 (R;US)

Fernwaerme-Forschungsinstitut in Hannover e.V., Hemmingen (Germany, F.R.)
Options and techniques for enhanced waste heat recovery in small- and medium-sized enterprises. A guideline, 15:2731 (R;DE;In German)

Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland)
Studies of potential severe accidents in Finnish nuclear power plants. Quarterly report 3. quarter 1987, 15:2450 (R;FI)

Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Dept. of Nuclear Safety
Operation of Finnish nuclear power plants. Quarterly report, 2. quarter 1988, 15:2451 (R;FI)
Operation of Finnish nuclear power plants. Quarterly report, 3. quarter 1988, 15:2452 (R;FI)

Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center
Assessment of smolt condition for travel time analysis: Annual report 1988, 15:2279 (R;US)

Fish and Wildlife Service, Washington, DC (USA)
Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook, 15:2601 (R;US)
Migration of radio-marked whooping cranes from the Aransas-wood buffalo population: Patterns of habitat use, behavior, and survival. Technical report, 15:2602 (R;US)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Alewife and blueback herring, 15:3536 (R;US)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Brown rockfish, copper rockfish, and black rockfish, 15:3537 (R;US)

Fish and Wildlife Service, Washington, DC (USA). Office of Management Authority
Convention on international trade in endangered species of wild fauna and flora. 1987 annual report. Final report, 15:3613 (R;US)

Florida State Univ., Tallahassee, FL (USA). Dept. of Physics
Research in theoretical physics: Technical progress report, 15:4033 (R;US)

Florida State Univ., Tallahassee, FL (USA). Inst. of Molecular Biophysics
The impact of energy related pollutants on chromosome structure: Progrss report, May 1, 1987–April 30, 1990, 15:3761 (R;US)

Florida Univ., Gainesville, FL (USA)
A new approach in ultrapurification of coal by selective flocculation: Annual report, 15:2024 (R;US)
Gene-enzyme relationships in somatic cells and their organismal derivatives in higher plants: Progress report, August 1, 1988–July 31, 1989, 15:3602 (R;US)

Flygtekniska Foersoeksanstalten, Stockholm (Sweden)
Evaluation of the relation (coherence) between wind speed and various set parameters at the Naesudden wind power plant, 15:2386 (R;SE;In Swedish)

Food and Agriculture Organization of the United Nations, Rome (Italy)
Activities of the Entomology Unit. Report No.1, 1988, 15:3687 (R;XA)

Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health
Handbook of selected tissue doses for projections common in diagnostic radiology, 15:3679 (R;US)

Foreign Technology Div., Wright-Patterson AFB, OH (USA)
Thermodynamic principles of the process of the effect of electromagnetic fields on a polymer melt, 15:3799 (R;US)

Forest Service, Aiken, SC (USA). Southeastern Forest Experiment Station
Establishment of a viable population of red-cockaded woodpeckers at the Savannah River Site: Progress report, FY 1989, 15:3492 (R;US)

Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station
Fuel-supply structure of wood-fired power plants in the Northeast: Loggers' perspective. Forest Service research paper, 15:2273 (R;US)

Forest Service, Portland, OR (USA). Pacific Northwest Research Station
Geographic variation in red alder. Forest Service research paper, 15:2299 (R;US)

Forest Service, St. Paul, MN (USA). North Central Forest Experiment Station
Microcomputer Scientific Software Series 5: The Biomass User's Manual. Forest Service general technical report, 15:2298 (R;US)
Physical characteristics of study plots. Across-a-Lake States acidic-deposition gradient. Forest Service resource bulletin, 15:3455 (R;US)

Forschungsstelle fuer Energiewirtschaft, Muenchen (Germany, F.R.)
Options and techniques for enhanced waste heat recovery in small- and medium-sized enterprises. A guideline, 15:2731 (R;DE;In German)

Frank J. Seiler Research Lab., United States Air Force Academy, CO (USA)
Nuclear magnetic resonance in molten salts, 15:4202 (R;US)

Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.). Bereich Waerme/Klima
Are the external heat transfer coefficients correct?, 15:2680 (R;DE;In German)

Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin (Germany, F.R.)
Investigation of the formation and chemical aspects of coke deposits occurring on acid, monofunctional zeolite catalysts through typical reactions with hydrocarbons, 15:2270 (R;DE;In German)

Fugro Geotechniek BV, Arnhem (Netherlands)
Evaluation of the energy conservation program for the NMB bank offices, 15:2677 (R;NL;In (In Dutch))
Evaluation of the energy conservation program for the NMB bank offices. Appendices and figures, 15:2678 (R;NL;In (In Dutch))
Investigation of the indoor air quality of renovated houses in Bois-le-Duc, Netherlands, 15:2704 (R;NL;In (In Dutch))

G

GA Technologies, Inc., San Diego, CA (USA)
The TITAN Reversed-Field Pinch fusion reactor study: Collection of papers, 15:4443 (R;US)

Gas Research Inst., Chicago, IL (USA)
Review of physical science research, 1979-1988, 15:2136 (R;US)

General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.
Federal research: Determination of the best qualified sites for DOE's super collider, 15:3320 (R;US)
Water pollution: More EPA action needed to improve the quality of heavily polluted waters, 15:3547 (R;US)

General Atomics Co., San Diego, CA (USA)
Upgrade plans to handle 30 to 40 Mbytes of data for DIII-D, 15:4409 (R;US)

General Atomics, San Diego, CA (USA)
An interior vessel viewing system for DIII-D, 15:4408 (R;US)
Beam current regulation of DIII-D neutral beam long pulse ion sources, 15:4415 (R;US)
Data file management in the DIII-D data acquisition and analysis computer systems, 15:4412 (R;US)
Design of DIII-D Advanced Divertor, 15:4410 (R;US)
DIII-D cryogenic control system upgrade, 15:4411 (R;US)
DIII-D F-coil chopper selection, control and fault recognition system, 15:4413 (R;US)
Effect of energetic particle absorption on fast wave current drive, 15:4312 (R;US)
High-temperature ceramic superconductors. Annual technical report, 24 May 1988-30 June 1989, 15:2899 (R;US)
Mechanical design of an infrared imaging system for DIII-D, 15:4414 (R;US)
Mechanical design of the Inside Launch system for electron cyclotron heating in DIII-D, 15:4407 (R;US)
Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)

General Electric Co., Cincinnati, OH (USA). Aircraft Engines
Advanced gas-turbine steam-injection program water treatment for steam-injected gas-turbine systems. Topical report, October 1987-March 1989, 15:2417 (R;US)

General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation
Radiological Sciences Department Annual report: Research and development, Fiscal year 1955, 15:3504 (R;US)

General Motors Corp., Indianapolis, IN (USA). Allison Gas Turbine Div.
Coal-fueled diesel systems research: Volume 1, Basic fuel, fuel system, and combustion studies: Final report, 15:2798 (R;US)
Coal-fueled diesel systems research: Volume 2, Engine operation, durability and economic: Final report, 15:2799 (R;US)

General Motors Corp., La Grange, IL (USA). Electro-Motive Div.
Coal-fueled diesel systems research: Volume 2, Engine operation, durability and economic: Final report, 15:2799 (R;US)

General Sciences Corp., Laurel, MD (USA)
[Analysis of acid rain and associated phenomena]: Final report, 15:2077 (R;US)

Geo-Centers, Inc., Newton Upper Falls, MA (USA)
High-energy-density solid and liquid hydrocarbon fuels. Final report, July 1987-December 1988, 15:2120 (R;US)

Geological Survey, Madison, WI (USA). Water Resources Div.
Water resources data for Wisconsin, Water Year 1988. Water-data report (Annual), 1 October 1987-30 September 1988, 15:3559 (R;US)

Georgia Inst. of Tech., Atlanta, GA (USA)
Evaluation of hypotheses for the cause of the 1886 Charleston earthquake: Final report, 15:3813 (R;US)

Georgia Inst. of Tech., Atlanta, GA (USA). School of Aerospace Engineering
Pulsating catalytic combustion of gaseous fuels. Final report, January 1987-September 1988, 15:2152 (R;US)

Georgia Univ., Athens, GA (USA)
Validation and application of pharmacokinetic models for interspecies extrapolations in toxicity risk assessments of volatile organics. Annual report No. 2, 1 July 1988-30 June 1989, 15:3757 (R;US)

Georgia Univ., Athens, GA (USA). Georgia Cooperative Fishery Research Unit
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Alewife and blueback herring, 15:3536 (R;US)

Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)
Review of LOFT [Loss-of-Fluid Test] large break experiments: OECD LOFT project, 15:2551 (R;US)

Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)
Measures for reduction of severe accident consequences: Comprehensive evaluation of the results sponsored by the BMI, 15:2495 (R;DE;In German)

Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Hydrologie
Distribution of heavy metals and anions in the groundwater of quaternary gravel deposits in the Munich area (Dornach). Laboratory and field test results, 15:3540 (R;DE;In German)

GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)
Irradiation programs to establish the safety margins of German licensing rules related to RPV steel embrittlement, 15:2465 (R;DE)
The consideration of irradiation embrittlement of RPV steels in German licensing rules as compared to recent results of irradiation experiments, 15:2835 (R;DE)

Gorham Advanced Materials Inst., ME (USA)
A global assessment of the business impacts of high transition temperature superconducting ceramic materials on permanent magnet producers, users, and raw materials suppliers 1987–2002, 15:2917 (R;US)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii
Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987, 15:4416 (R;XA)

H

Hanford Works, Richland, WA (USA)
Columbia River situation: A semi-technical review, 15:3548 (R;US)
Preliminary report, KW reactor incident, 15:2527 (R;US)
Radiological Sciences Department annual report, research and development, fiscal year 1954, 15:3503 (R;US)

Hannover Univ. (Germany, F.R.). Fachbereich Physik
HTO deposition through gas exchange between soil and atmosphere, 15:3507 (R;DE;In German)

Hannover Univ. (Germany, F.R.). Inst. fuer Kolbenmaschinen
Determination of the dependence of engine characteristics on the properties of alternative fuels, 15:2800 (R;DE;In German)

Hannover Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik
Critical investigations and model development on countercurrent flow of gas and liquid in horizontal and vertical channels. Final report, 15:2530 (R;DE;In German)

Hannover Univ. (Germany, F.R.). Inst. fuer Werkstoffkunde
Development of a technique for dismantling geometric complicated and thick components of closed down nuclear power plants with the principle of arc-waterjet cutting. Final report, 15:2532 (R;DE;In German)

Harmony Thermal Co., Wichita, KS (USA)
Extended range tankless water heater: Quarterly report, April 19–July 19, 1989, 15:2725 (R;US)
Extended range tankless water heater: Quarterly report No. 2, July 20, 1989–October 19, 1989, 15:2671 (R;US)

Havnecon Consulting A/S, Lemvig (Denmark)
Windmills standing on the sea bed at Dvalegrunden. Draft project, 15:2364 (R;DK;In Danish)

Hazardous Materials Technical Center, Rockville, MD (USA)
Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska, 15:2716 (R;US)
Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska, 15:2717 (R;US)
Installation-Restoration Program Preliminary Assessment, Naknek Recreational Camps, Alaska, 15:2718 (R;US)
Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska, 15:2719 (R;US)
Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska, 15:2720 (R;US)
Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska, 15:2721 (R;US)
Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska, 15:2722 (R;US)
Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska, 15:2723 (R;US)

Helsinki Univ. of Technology, Espoo (Finland). Systems Analysis Lab.
Dynamic cooperative electricity exchange in a power pool. Research report, 15:2640 (R;FI)

Helsinki Univ. of Technology, Otaniemi (Finland)
Studies of potential severe accidents in Finnish nuclear power plants. Quarterly report 3. quarter 1987, 15:2450 (R;FI)

Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics
(2+1)-dimensional quantum gravity, 15:4287 (R;JP)

Hoffmann (H.) og Soenner A/S, Gentofte (Denmark)
Windmills standing on the sea bed at Dvalegrunden. Draft project, 15:2364 (R;DK;In Danish)

Hoofdgroep Maatschappelijke Technologie TNO, Apeldoorn (Netherlands)
Measuring heat flows in collective heating systems. Illusion or reality, 15:2702 (R;NL;In (In Dutch))
Measuring heat flows in collective heating systems. Appendices and figures, 15:2703 (R;NL;In (In Dutch))

Humboldt State Univ., Arcata, CA (USA). California Cooperative Fishery Research Unit
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Brown rockfish, copper rockfish, and black rockfish, 15:3537 (R;US)

Hycrude Corp., Chicago, IL (USA)
Beneficiation-hydroretort processing of US oil shales, Volume 1: Final report, 15:2155 (R;US)

I

ICF Technology, Inc., Fairfax, VA (USA)
Response to comments: Background document for the second third-land disposal restrictions proposed rule: Policy-related comments, 15:3518 (R;US)

Idaho Dept. of Fish and Game, Eagle, ID (USA). Eagle Fish Health Lab.
State of Idaho augmented anadromous fish health monitoring: Annual report, FY 1988, 15:2281 (R;US)

IIT Research Inst., Chicago, IL (USA)
ELF (extremely low frequency) communications system ecological monitoring program: Electromagnetic field measurements and engineering support – 1988. Technical report, 1982-1988, 15:3795 (R;US)

Illinois Inst. of Tech., Chicago, IL (USA)
Continuation of gas technology, basic research, and education. Final report, August 15, 1985-August 15, 1988, 15:2137 (R;US)

Illinois Univ., Urbana, IL (USA)
Ash and burn control through fishbones, 15:4302 (R;US)
Control of ash accumulation by induced-fishbones, 15:4398 (R;US)
Electroabsorption in single quantum-well GaAs laser structures, 15:3150 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Chemical Engineering
Supercritical fluid thermodynamics for coal processing: Quarterly progress report, July 1, 1989–September 30, 1989, 15:2055 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Electrical and Computer Engineering
Semiconductor quantum-well lasers and related optoelectronic devices on silicon, III-V. Technical report, 15:3145 (R;US)

Industrias Nucleares do Brasil SA, Rio de Janeiro, RJ (Brazil)
Determination of U-235 quantity in non-irradiated nuclear fuels using the neutrons coincidence method, 15:2168 (R;BR;In Portuguese)

Innosys ApS, Copenhagen (Denmark)
Utilization of computerized control for optimization of energy systems, 15:2762 (R;DK;In Danish)

Instatherm Co., Cary, NC (USA)
Fuel savings in the heavy trucking industry through cool storage: Technical progress report, June 20–September 19, 1989, 15:2563 (R;US)

Institut fuer Erdoelforschung, Clausthal-Zellerfeld (Germany, F.R.)
Crude oil emulsions. Abstracts, 15:2108 (R;DE;In German)

Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni
Abstracts of 14th radiation hygiene days, 15:4191 (R;CS;In Czech, Slovak)

Instituto Brasileiro do Petroleo, Rio de Janeiro, RJ (Brazil)
Aspects of radiological protection in nuclear installations, 15:4187 (R;BR;In Portuguese)
Oil wells and gas wells: aspects of radiological safety, 15:2123 (R;BR;In Portuguese)
Radiological protection. Responsibility of the Safety Engineering Company, 15:4188 (R;BR;In Portuguese)
Safety in transport and storage of radioactive materials, 15:2172 (R;BR;In Portuguese)

Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Mecanica Estrutural
EVP2D- a computer code developed for the eslastoviscoplastic-damage analysis of axyssimetrical and two-dimensional problems, 15:2836 (R;BR;In Portuguese)

Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Quimica
Zirconium nitrate preparation and analytical method of zirconium determination in extraction experiments. pt.1, 15:3043 (R;BR;In Portuguese)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)
Activities of the neutron activation analysis laboratory of the radiochemistry division of IPEN - CNEN/SP, 15:4494 (R;BR;In Portuguese)
Determination of gadolinium in power and pellers of $(U,Gd)O_2$ by ion chromatography without supresion, 15:3050 (R;BR;In Portuguese)
Determination of HF in UF_4 contaminated by UO_2F_2, 15:2161 (R;BR;In Portuguese)
Effects of gamma radiation on Crotalus durissus terrificus venom, 15:3696 (R;BR;In Portuguese)
Electrodeposition and evaporation techniques used for preparation of ^{239}Pu sources. Determination by alpha spectrometry, 15:3052 (R;BR;In Portuguese)
Gastrin labelled at IPEN-CNEN/SP-Brazil. Comparison with a commercial tracer, 15:3104 (R;BR)
Obtention of crystals feom thorium nitrate using microwave as heating source, 15:3103 (R;BR;In Portuguese)
Quality control of radioimmunoassay technique for gastrine dosage, 15:3622 (R;BR;In Portuguese)
Rapid method for purification of radioiodinated glucagon, 15:3623 (R;BR;In Portuguese)
Simultaneous determination of some nutrient elements in five varieties of maize by instrumental neutrons activation analysis, 15:3048 (R;BR;In Portuguese)
Some aspects of analytic control used in separation process of rare earths, 15:3049 (R;BR;In Portuguese)
Study for the determination of samarium, europium,terbium, dysprosium and yttrium in gadolinium oxide matrix by means of atomic absorption spectrophotometry using a graphite furnace, 15:3058 (R;BR;In Portuguese)
Study on behaviour of voltametric wave of UO_2^{2+} in an electrode of mercury pendent drop and H_2SO_4 as suport electrolyte, 15:3051 (R;BR;In Portuguese)
Thorium re-improvement of residues from thorium purification plants, 15:2169 (R;BR;In Portuguese)
Use of uranium in filtrated from preparation process uranium tetrafluoride by umid via, 15:2162 (R;BR;In Portuguese)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Div. de Assistencia Medico-Social
Nursering assistance to the radiological accident patients in Goias-Brazil, 15:3697 (R;BR;In Portuguese)

Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil)
Acute radiation syndrome in the ^{137}Cs Brazilian accident, 1987, 15:3698 (R;BR)
Description of the objectives and activities of Radioprotection and Dosimetry Institute - IRD, 15:4493 (R;BR;In Portuguese)
Internal progress report of operational environmental monitoring in the region of Pocos de Caldas, MG, Brazil, 15:2487 (R;BR;In Portuguese)
Radiological survey of Goiania by a mobile monitoring unit, 15:4186 (R;BR)

Integral Technologies, Inc., Westmont, IL (USA)
Computer simulation of wind/diesel system operation, 15:2383 (R;US)

Interagency Nuclear Safety Review Panel (USA)
Interagency Nuclear Safety Review Panel: Safety evaluation report for Galileo: Volume 2, 15:2651 (R;US)
Safety evaluation report for Galileo: Volume 1, 15:2650 (R;US)

International Atomic Energy Agency, Vienna (Austria)
A preliminary modeling and analysis framework for severe accident analysis of high power density research reactors, 15:2528 (R;AT)
Activities of the Entomology Unit. Report No.1, 1988, 15:3687 (R;XA)
Agreement of 20 September 1988 between the People's Republic of China and the International Atomic Energy Agency for the application of safeguards in China, 15:2245 (R;XA)
Members of the Agency. List of 1 September 1989, 15:4492 (R;XA)
Power reactor information system (PRIS). Reference and on-line access manual, 15:2434 (R;XA)
Quality control scheme for thyroid related hormones measured by radioimmunoassay. Final report for the period 1 January 1985 - 1 April 1989, 15:3620 (R;XA)

International Atomic Energy Agency, Vienna (Austria). Atomic and Molecular Data Unit
International bulletin on atomic and molecular data for fusion. No. 39, 15:4317 (R;XA)

International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee
Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988, 15:4134 (R;XA)
Translation of reports from the first international conference on neutron physics, Kiev, USSR, 14-18 September 1987, 15:4179 (R;XA)
Translation of selected papers published in Nuclear Constants 4, 1986, 15:4112 (R;XA)
Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987, 15:4416 (R;XA)

International Bank for Reconstruction and Development, Washington, DC (USA)
Safe disposal of hazardous wastes: The special needs and problems of developing countries. Volume 1-Volume 3. World Bank technical paper, 15:2750 (R;US)

International Centre for Theoretical Physics, Trieste (Italy)
Bergman spaces, the Bloch space and the pluriharmonic conjugates in the unit ball of C^n, 15:4264 (R;XA)
Composite scalar mesons in QCD, 15:3988 (R;XA)
Construction of second constant of motion for two dimensional classical super systems, 15:4263 (R;XA)
Cubic interaction in conformal theory of integer higher-spin fields in four dimensional space-time, 15:4039 (R;XA)
Current measurement studies around the Cesme Peninsula (Turkey), 15:3569 (R;XA)
D^p spaces on bounded symmetric domains of C^n, 15:4265 (R;XA)
Double beta decay matrix elements in the Germanium region, 15:4133 (R;XA)
Electron correlations and dielectric screening in a layered electron gas, 15:4219 (R;XA)
Generalized canonical quantization of dynamical systems with constraints and curved phase space, 15:4272 (R;XA)
Generation of axial and lateral magnetic fields in laser produced plasmas, 15:4315 (R;XA)
Geometry and quantization of topological gauge theories, 15:4041 (R;XA)
Harmonic mappings into manifolds with boundary, 15:4282 (R;XA)
Induction on a continuous variable, 15:4269 (R;XA)
Interface stress theorem and Hellmann-Feynman relations for Bijellic systems, 15:4220 (R;XA)
Investigation of the non linear Buneman instability in a multi ion plasma, 15:4313 (R;XA)
Ion-sound emission by Langmuir soliton reflected at density barrier, 15:4316 (R;XA)
Irreversibility and self-organization in spin glasses. 1. Origin of irreversibility in spin glasses, 15:4213 (R;XA)
Irreversibility and self-organization in spin glasses. 2. Irreversibility and the problem of configuration averaging, 15:4214 (R;XA)
Iterative methods for nonlinear set-valued operators of the monotone type with applications to operator equations, 15:4267 (R;XA)
Level-one SU(3) Wess-Zumino model on higher genus Riemann surfaces, 15:4036 (R;XA)
Local coordination of polyvalent metal ions in molten halide mixtures, 15:4218 (R;XA)
Magnetoplasma oscillations of the wave-guided type in semiconductor superlattices, 15:4216 (R;XA)
Minimal prime ideals in semigroups without nilpotent elements, 15:4278 (R;XA)
N=2 supergravity in superspace and the BRS symmetry, 15:4276 (R;XA)
New spacetime superalgebras and their Kac-Moody extension, 15:4266 (R;XA)
Note on p-semisimple BCI-algebras, 15:4275 (R;XA)
On prime ideals and associated spectrum of BCK-algebras, 15:4280 (R;XA)
On pure radical in semigroups with zero, 15:4274 (R;XA)
On the continuity of the Nemitsky operator induced by a Lipschitz continuous map, 15:4281 (R;XA)
On the interactions of charged particles with cosmic string, 15:3987 (R;XA)
On the quantum inverse problem for a new type of nonlinear Schroedinger equation for Alfven waves in plasma, 15:4314 (R;XA)
Pair production in an electric field in a time-dependent gauge, 15:4040 (R;XA)
Polarization asymmetries of large P_t leptons at hadron colliders in E_6 theories, 15:3989 (R;XA)
Positive energy bound states, 15:4132 (R;XA)
Projective cohomology over a chain complex, 15:4279 (R;XA)
QED based on self-energy: The relativistic $2S_{1/2} \rightarrow 1S_{1/2}+1\gamma$ decay rates of hydrogenlike atoms, 15:3888 (R;XA)
Quantum sl(2) enveloping algebra and representations of braid group, 15:4271 (R;XA)
Renormalization scheme dependence in the next-to-next-to-leading order and the high energy behaviour in QCD, 15:3990 (R;XA)
Search for proton decay and supernova neutrino bursts with a lunar base neutron detector, 15:3954 (R;XA)
Self similar solutions of the second kind of nonlinear diffusion-type equations, 15:4273 (R;XA)
Self-similar growth of three-dimensional fault, 15:3810 (R;XA)
Simple application of probability model for the mean age at marriage, 15:4277 (R;XA)
Simultaneous creation of electron-positron pairs and photons in Robertson-Walker universes with statically bounded expansion, 15:4035 (R;XA)
Solution of a class of conformal quantum field theory models in D-dimensional space, 15:4038 (R;XA)
Solvability in $D^{1,2}(\Omega)$ of the equation $-\Delta u+c=Ke^u$, 15:4268 (R;XA)
Statistical mechanical models for liquid and amorphous structure in covalently bonded systems, 15:4217 (R;XA)
Strain induced amorphization of aluminium by manganese implantation, 15:4215 (R;XA)
Studies of the effect of age on the structure of polycrystalline ReO_3, 15:2918 (R;XA)
Thermal stress and seismogenesis, 15:3809 (R;XA)
Two-centre electron scattering phase shifts calculated to higher orders using the generalized JWKB method, 15:4131 (R;XA)
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)
$U_q(sl(2))$ invariant operators and minimal theories fusion matrices, 15:4270 (R;XA)
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)
Vortex-like and string-like solutions for the 2+1 dimensional SU(2) Yang-Mills theory with the Chern-Simons term, 15:4037 (R;XA)
Wakefield accelerator in a magnetized electron-positron plasma, 15:3262 (R;XA)

International Energy Agency, 75 - Paris (France)
Joint action on aerodynamics of wind turbines, 15:2365 (R;DK)
Joint action on aerodynamics of wind turbines. Supplement, 15:2379 (R;DK)

International Ground Water Modeling Center, Indianapolis, IN (USA)
Establishment of a Ground Water Research Data Center for validation of subsurface flow and transport models. Final report, August 1986-November 1988, 15:3557 (R;US)

Iowa Dept. of Natural Resources, Des Moines, IA (USA)
Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly, 15:3580 (R;US)
Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly. Appendix 2. Written comments, 15:3581 (R;US)

Iowa State Univ. of Science and Technology, Ames, IA (USA)
Investigation of physical structures and interactions at high energy. [Progress report, October 1988--October 1989], 15:3949 (R;US)

Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy
CRRES (Combined Release and Radiation Effects Satellite) SAPCERAD Plasma Wave Experiment. Final report, 20 April 1982-30 June 1988, 15:3683 (R;US)

Iraq Atomic Energy Commission, Baghdad (Iraq). Nuclear Research Centre
Quality control scheme for thyroid related hormones measured by radioimmunoassay. Final report for the period 1 January 1985 - 1 April 1989, 15:3620 (R;XA)

Istituto Nazionale di Fisica Nucleare, Rome (Italy)
Structure functions and initial-final state interference in QED, 15:4042 (R;IT)

Itasca Consulting Group, Inc., Minneapolis, MN (USA)
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1, 15:2215 (R;US)
FLAC (Fast Lagrangian Analysis of Continua), Version 2.20: User's manual, 15:2216 (R;US)
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Verification, example and benchmark problems: Volume 3, 15:2217 (R;US)
UDEC (Universal Distinct Element Code) version ICG1.5: User's manual: Volume 2, 15:3816 (R;US)

J

Jacobs Engineering Group, Inc., St. Charles, MO (USA)
Phase 1 spring and seep report: Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri: Revision 0, 15:2242 (R;US)

Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment
Activation cross section data file, 15:4157 (R;JP;In Japanese)
Measurements of prompt fission neutron spectra and double-differential neutron inelastic-scattering cross sections for ^{238}U and ^{232}Th, 15:4119 (R;JP;In Japanese)
Polarized proton scattering on lithium isotopes at 14 MeV, 15:4427 (R;JP)

Japan Atomic Energy Research Inst., Tokyo (Japan)
1-dimensional single-mode nonlinear FEL amplification code. User's manual, 15:4339 (R;JP;In Japanese)
1MeV-electron irradiation induced defects in epitaxially grown 3C-SiC, 15:2920 (R;JP)
BWR plant dynamic analysis code BWRDYN user's manual, 15:2439 (R;JP;In Japanese)
Design study of high breeding fast reactor. FP gas purge/tube-in-shell metallic fuel fast reactor, 15:2462 (R;JP;In Japanese)
Development and application of an on-line tritium production rate measuring method, 15:4421 (R;JP)
Effect of electron-excitation on radiation damage in ion-irradiated FCC metals, 15:4230 (R;JP;In Japanese)
Energy conversion efficiency in high current Raman regime free electron laser (FEL), 1. Single mode analysis, 15:4341 (R;JP)
ERATO-code analysis of vacuum magnetic field oscillations in JT-60 divertor configuration, 15:4425 (R;JP;In Japanese)
Estimation method of reionization loss in the drift ducts for JT-60 NBI, 15:4422 (R;JP;In Japanese)
Estimation of thermodynamic properties of alloys from phase diagram and other loose boundary conditions, 15:2838 (R;JP;In Japanese)
Fabrication of uranium-plutonium mixed carbide fuel pins for JMTR irradiation capsules, 84F-10A, 84F-12A and 87F-2A, 15:2461 (R;JP;In Japanese)
Flux and power spectra of photon sources from bending magnets and insertion devices at a 8 GeV storage ring, 15:3324 (R;JP)
Fracto-fusion. Mechanism of cold fusion, 15:4156 (R;JP)
Gamma-ray irradiation effects of poly(ethylene-2, 6-naphthalate) and poly(ethylene-terephthalate), 15:2972 (R;JP;In Japanese)
Heat and momentum transfer in a gas coolant flow through a circular pipe in a high temperature gas cooled reactor, 15:2453 (R;JP;In Japanese)
Low energy neutral particle energy analyser by time of flight method, 15:4420 (R;JP;In Japanese)
Measurement of impurities in a volume produced H^- ion beam, 15:4426 (R;JP;In Japanese)
Quick installation/removal technology for first wall, 15:4424 (R;JP;In Japanese)
Radiation resistance of solar cells for space application, 1. Study on the irradiation procedure of electron beams, 15:2294 (R;JP;In Japanese)
Review on fission product source term from fuel at severe accident conditions, chemical forms and release rates, 15:2534 (R;JP;In Japanese)
Ripple loss of alpha particles in ITER, 15:4340 (R;JP)
Stabilities of dimension and thermal-resistance of ASR-ORB carbon for thermal barrier materials of HTTR, 15:2491 (R;JP;In Japanese)
Study on shaft vibration of gas circulators with gas-bearings for HENDEL helium test facility, 15:2454 (R;JP;In Japanese)
Study on the behavior of PWR remedy fuel under reactivity initiated accident conditions. Effect of pellet shape modification, 15:2533 (R;JP;In Japanese)
Study on the behavior of waterside corroded PWR fuel rods under reactivity initiated accident conditions, 15:2535 (R;JP;In Japanese)
Thermal-hydraulics of actinide burner reactors. Conceptual study of actinide burner reactors, (3), 15:2471 (R;JP;In Japanese)
Undulator sources at a 8 GeV storage ring, 15:3323 (R;JP)
Upgrade of JT-60 pellet injector for higher velocity, 15:4423 (R;JP;In Japanese)
Verification study of a three-dimensional local scale atmospheric model PHYSIC at seacoast region, 15:3479 (R;JP)

Jet Propulsion Lab., Pasadena, CA (USA)
Interplanetary particle environment. Proceedings of a conference, 15:3361 (R;US)

Johns Hopkins Univ., Baltimore, MD (USA)
Regional aerosol deposition in human upper airways: Annual progress report, March 1, 1989–February 28, 1990, 15:3414 (R;US)
Walk-through survey report: Northeast Utilities Service Co./Stone and Webster Engineering Corp., Millstone Plant No. 3, Waterford, Connecticut, August 29, 1979, 15:3770 (R;US)

Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Chemical Engineering
Prediction of thermodynamic properties of coal derivatives: Progress report, March 1, 1989–February 28, 1990, 15:2054 (R;US)

Joint Inst. for Nuclear Research, Dubna (USSR)
Iterative methods of domain decomposition with cross-points for the solution of discrete elliptic problems, 15:4518 (R;SU)
Second class currents and the β-particle asymmetry at the decay of oriented ^{24m}Na nuclei, 15:4158 (R;SU)

Jysk Teknologisk, Aarhus (Denmark)
District heating connections with high consumption, 15:2761 (R;DK;In Danish)

Jysk Teknologisk, Aarhus (Denmark). Energiteknik
Diesel-driven heat pump applied to grain drying and chilling. Phase 2, 15:2734 (R;DK;In Danish)
Energy efficient method for evaporating concentrated aqueous solutions of temperature sensitive substances. Phase 1, 15:2733 (R;DK;In Danish)

Jyvaeskylae Univ. (Finland). Dept. of Physics
Beam dynamical studies of cryring. Quarterly report 3. quarter 1987, 15:3325 (R;FI)
Hydrodynamics in high-energy nuclear collisions. Quarterly report 3. quarter 1987, 15:4004 (R;FI)
Hydrogen and helium in metals: positron lifetime experiments. Quarterly report 3. quarter 1987, 15:2839 (R;FI)
Transfer reactions with very heavy ions. Quarterly report 3. quarter 1987, 15:4106 (R;FI)

K

Kaiser Engineers, Inc., Pittsburgh, PA (USA)
[Advanced physical fine coal cleaning: Froth flotation]: Quarterly technical progress report, July 1, 1989–September 30, 1989, 15:2016 (R;US)

Kansas State Biological Survey, Lawrence, KS (USA)
Use of micrometeorological parameters in the establishment of a VOC (volatile organic compounds) monitoring network. Technical report (Final), 15:3454 (R;US)

Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie
Analytical studies of plutonium containing solutions by Laser-Raman-Spectroscopy (LRS) with special regard to the Pu(IV)-Ru(III)-HNO_3 and Pu(VI)-H_2O_2-reactions, 15:3064 (R;DE;In German)

Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Mechanische Verfahrenstechnik und Mechanik
Investigations on combined deposition of particulate and gaseous pollutants in a packed bed filter at high temperatures, 15:2730 (R;DE;In German)

Karlsruhe Univ. (T.H.) (Germany, F.R.). Mineralogisches Inst.
Reactions and interactions of the reservoir rock with heat exchange media in the hot dry rock process: A case study in the Falkenberg granite, 15:2359 (R;DE;In German)

Kassel Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 15 - Maschinenbau
Experimental and theoretical investigation of passive use of solar energy on house facades, 15:2676 (R;DE;In German)

Kauppa- ja Teollisuusministerio, Helsinki (Finland). Energiaosasto
Alternative development programme of the projects concerning the building management control, 15:2682 (R;FI;In Finnish)
Design instructions for ventilation of day-care centres, 15:2684 (R;FI;In Finnish)
Displacement ventilation - dimensioning of supply air flow, 15:2683 (R;FI;In Finnish)
Gasification of solid fuels in energy management of industry, 15:2030 (R;FI;In Finnish)

Keller (Ed), Santa Barbara, CA (USA)
The ecology of riparian habitats of the southern California coastal region: A community profile, 15:3538 (R;US)

Keo Consultants, Brookline, MA (USA)
Optical instrumentation support for the airborne ionospheric observatory. Report for 1 July 1987-30 June 1988, 15:3884 (R;US)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Sicherheit und Strahlenschutz
Documentation of the first measuring campaign of September 8-12, 1986 within the framework of the research project 'Dispersion of pollutants in complex terrain after short-term emissions', 15:3392 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie
Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie
Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report, 15:3506 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Internationales Buero
Program of research and development on the thorium utilization in PWRS. Final report (1979-1988), 15:2449 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik
Uncertainty analyses for the atmospheric dispersion submodule of UFOMOD with emphasis on parameter correlations, 15:3481 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung
Algorithms and programs for evaluating fault trees with multi-state components, 15:4519 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre
5th status colloquium of the PEF, March 7-9, 1989 in the Nuclear Research Center in Karlsruhe. Summarizing reviews of the program management, 15:3416 (R;DE;In German)
Changes in ground vegetation of forest ecosystems in the middle and southern regions of the Black Forest, 15:3763 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung
Analytical studies of plutonium containing solutions by Laser-Raman-Spectroscopy (LRS) with special regard to the Pu(IV)-Ru(III)-HNO_3 and Pu(VI)-H_2O_2-reactions, 15:3064 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit (PRS)
Uncertainty analyses for the atmospheric dispersion submodule of UFOMOD with emphasis on parameter correlations, 15:3481 (R;DE)

Kohler Corp., WI (USA)
Residential cogeneration system development. Annual interim report, February 1988-January 1989, 15:2777 (R;US)

KRAFTSAM, Stockholm (Sweden)
Electricity supply in Sweden 1988, 15:2638 (R;SE;In Swedish)

Krug International, San Antonio, TX (USA). Technology Services Div.
Behavioral measurement of laser flashblindness in rhesus monkeys. Final report, June-August 1985, 15:3796 (R;US)

KRW Energy Systems, Inc., Pittsburgh, PA (USA)
Advanced gasifier-desulfurizer process development for SNG (substitute natural gas) application. Final report, August 1987-December 1988, 15:2047 (R;US)

Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.
Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1988, 15:4159 (R;JP;In Japanese)

Kyoto Univ., Uji (Japan). Plasma Physics Lab.
Biased limiter experiment in the Heliotron E device, 15:4441 (R;JP)
Density clamping phenomena in electron cyclotron resonance heated plasmas on Heliotron E, 15:4344 (R;JP)
Effect of loss cone on confinement in toroidal helical device, 15:4348 (R;JP)
In situ measurement of neutral beam components using the Doppler-shifted H_α emissions in Heliotron E, 15:4345 (R;JP)
Investigation of boundary for the negative ion extraction in the sheet-plasma negative ion source, 15:4349 (R;JP)
Phase properties of the rapid cooled palladium-silicon alloy in the concentration range 40 to 58 at.% Si, 15:2851 (R;JP)
Proceedings of US-Japan workshop on new generation experiments and reactors (joined by EC), 15:4440 (R;JP)
Second harmonic electron cyclotron heating in low and over density plasmas in Heliotron DR, 15:4347 (R;JP)
STEP code improvements and extensions, 15:4346 (R;JP)
Study on edge plasma physics and particle control in the Heliotron E device, 15:4343 (R;JP)

L

Laboratoriet for Energiforskning, Odense (Denmark)
Electromagnetic flywheel energy storage for use in electric powered trucks and vehicles for domestic transport, 15:2561 (R;DK;In Danish)

Laboratorio Nacional de Computacao Cientifica, Rio de Janeiro, RJ (Brazil)
Error analysis of some Galerkin - least squares methods for the elasticity equations, 15:3192 (R;BR)
Finite element approximations of the stokes flow problem based upon various variational principles, 15:3193 (R;BR)
Strong source heat transfer simulations based on a GalerKin/Gradient - least - squares method, 15:3194 (R;BR)

Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)
Hints and search strategies for the substances listed in the Accident Ordinance, 15:3803 (R;DE;In German)

Law Environmental, Inc., Kennesaw, GA (USA)
Evaluation of hypotheses for the cause of the 1886 Charleston earthquake: Final report, 15:3813 (R;US)

Lawrence Berkeley Lab., CA (USA)
A high charge state multicusp ion source, 15:3304 (R;US)
A review of assumptions and analysis in EPRI EA-3409: "Household appliance choice: Revision of REEPS [Residential End-use Energy Planning System] behavioral models", 15:2686 (R;US)
A study of aggregation bias in estimating the market for home heating and cooling equipment, 15:2687 (R;US)
A study of phase control in the FEL [free electron laser] two-beam accelerator, 15:3272 (R;US)
A tomographic study of premixed turbulent stagnation point flames, 15:3108 (R;US)

A versatile procedure for calculating heat transfer through windows, 15:2690 (R;US)
Abbreviated query interpretation in extended entity-relationship oriented databases, 15:4542 (R;US)
Accelerator and Fusion Research Division: 1988 summary of activities, 15:3259 (R;US)
An alternate end design for SSC dipoles, 15:3300 (R;US)
Analytic solution of pseudocolloid migration in fractured rock, 15:2212 (R;US)
Analytical models for C-14 transport in a partially saturated, fractured, porous media, 15:2209 (R;US)
Aspects of faceting in the study of percipitate interfaces, 15:2841 (R;US)
Binary complex fragment emission and multifragmentation from very hot nuclei, 15:4099 (R;US)
Broad-beam multi-ampere metal ion source, 15:3301 (R;US)
Center for Building Science of the Applied Science Division annual report, FY 1988, 15:2689 (R;US)
Center for X-ray Optics, 1988, 15:3264 (R;US)
Challenges for utilization of the new synchrotron facilities, 15:3266 (R;US)
Charge state distribution studies of the metal vapor vacuum arc ion source, 15:3302 (R;US)
Comparison of H^{minus} and D^{minus} production in a magnetically filtered multicusp source, 15:4439 (R;US)
Conformation, orientation and interaction in molecular monolayers: A surface second harmonic and sum frequency generation study, 15:4234 (R;US)
Delayed-fission properties of neutron-deficient americium nuclei, 15:4120 (R;US)
Design and testing of a superfluid liquid helium cooling loop, 15:3131 (R;US)
DNA damage in mammalian cells following heavy-ion irradiation, 15:3745 (R;US)
Earth Sciences Division annual report 1988, 15:3811 (R;US)
ECR sources for the production of highly charged ions, 15:3306 (R;US)
Effect of media properties on side erase bands, 15:4521 (R;US)
Effects of precipitate distribution on 293 K and 77 K properties of 2090-T81 weldments, 15:2840 (R;US)
Electronic materials high-T_c superconductivity polymers and composites structural materials surface science and catalysts industry participation: Annual report, 1988, 15:2923 (R;US)
Evaluation methods in competitive bidding for electric power: Volume 2, Technical appendix, 15:2635 (R;US)
Event-join optimization in temporal relational databases, 15:4543 (R;US)
Factors influencing soil as a source of indoor radon: Framework for assessing radon source potential, 15:2688 (R;US)
Gas flow in and out of a nuclear waste container, 15:2211 (R;US)
General properties of an asymmetric B-factory lattice, 15:3273 (R;US)
Geotechnical support and topical studies for nuclear waste geologic repositories: Annual report, fiscal year 1988, 15:2208 (R;US)
Ground motion measurements at the 1 - 2 GeV synchrotron radiation source site, 15:3299 (R;US)
Heavy Ion Fusion Accelerator Research (HIFAR) half-year report, October 1, 1988–March 31, 1989, 15:4438 (R;US)
High school honors program, July 23–August 5, 1989: Revision, October 1989, 15:2609 (R;US)
Improved charge collection of the buried p-i-n a-Si:H radiation detectors, 15:3354 (R;US)
Key issues in developing demand-side bidding programs, 15:2636 (R;US)
Least-cost planning in the utility sector: Progress and challenges: Volume 2, Technical appendix, 15:2624 (R;US)
Looking for precursors of neutron matter exotica, 15:4161 (R;US)
Low energy $\bar{p}p$ physics, 15:3960 (R;US)
Market share elasticities for fuel and technology choice in home heating and cooling, 15:2685 (R;US)
Mass transport in salt repositories: Transient diffusion into interbeds, 15:2206 (R;US)
Mass transport in salt repositories: Steady-state transport through interbeds, 15:2207 (R;US)
Molecular beam studies of oxygen atom reactions with unsaturated hydrocarbons, 15:3109 (R;US)
Monitoring and modeling for radon entry into basements: A status report for the small structures project, 15:2691 (R;US)
Operation of a DC large aperture volume-production H^- source, 15:3305 (R;US)
Operational characteristics of a metal vapor vacuum arc ion source, 15:3891 (R;US)
Optimizing voting-type algorithms for replicated data, 15:4541 (R;US)
Photofragmentation of ketene to $CH_2(\tilde{X}^3B_1)$ + CO: Dissociation rate, energy release and exit barrier height, 15:3096 (R;US)
Policies and programs for promoting energy conservation in the residential sector: Lessons from five OECD [Organization for Economic Cooperation and Development] countries, 15:2622 (R;US)
Quantum mechanical reactive scattering theory for simple chemical reactions: Recent developments in methodology and applications, 15:3077 (R;US)
Release rates of soluble species at Yucca Mountain, 15:2210 (R;US)
Residential energy demand in the six OCED countries: Historic trends and future directions, 15:2646 (R;US)
Retractable gas cooled leads for ASTROMAG, 15:3130 (R;US)
Review of SC/RF refrigeration systems, 15:3129 (R;US)
Scry: A distributed image handling system: Version 1.1, 15:4520 (R;US)
Search for the quark-gluon plasma (1989): The NA35 experiment at the CERN SPS, 15:4066 (R;US)
Soil water and vegetation management for cleanup of selenium contaminated soils: Progress report, 15:3498 (R;US)
Some new theoretical methods for treating reaction dynamics in polyatomic molecular systems, 15:3079 (R;US)
Some novel design features of the LBL metal vapor vacuum arc ion sources, 15:3303 (R;US)
Spatially resolved localized vibrational mode spectroscopy of carbon in liquid encapsulated Czochralski grown gallium arsenide wafers, 15:4233 (R;US)
Successful observation of Schottky signals at the Tevatron collider, 15:3307 (R;US)
Supernovae, compact stars and nuclear physics, 15:3828 (R;US)
Technology Base Research Project for electrochemical energy storage: Annual report for 1988, 15:2578 (R;US)
Testing string dynamics in lepton nucleus reactions, 15:4067 (R;US)
Tests of time reversal invariance via transmission experiments, 15:4023 (R;US)
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 1, Text and main figures, 15:2355 (R;US)
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 2, Appendices A through E, 15:2356 (R;US)
The challenges of third-generation synchrotron light source, 15:3265 (R;US)
The influence of oscillating electromagnetic fields on membrane structure and function: Synthetic liposome and natural membrane bilayer systems with direct application to the controlled delivery of chemical agents, 15:3802 (R;US)
The influence of texture on steady foam flow in Berea sandstone, 15:2111 (R;US)
The role of oil in electricity generation in five European countries: Past, present, and potential, 15:2631 (R;US)
The secondary slurry-zinc/air battery: Final report, 15:2579 (R;US)
Theoretical issues in the search for the quark gluon plasma, 15:4162 (R;US)
Theoretical methods for the study of chemical dynamics, 15:3078 (R;US)
Treatment planning for stereotactic heavy-charged particle radiosurgery of the brain, 15:3677 (R;US)
Variable temperature effects on release rates of readily soluble nuclides: Revision, 15:2205 (R;US)
Variational quantum Monte Carlo calculation of electronic and structural properties of crystals, 15:4235 (R;US)
VSP [Vertical Seismic Profiling] and cross hole tomographic imaging for fracture characterization, 15:3812 (R;US)
WES, a robust expert system for well test analysis, 15:2105 (R;US)

Lawrence Livermore National Lab., CA (USA)
2.5D EM direct implicit PIC simulation using AVANTI, 15:4356 (R;US)
A kinetic model for dissolution of borosilicate glass, 15:2240 (R;US)
A photon accelerator, 15:3279 (R;US)
A review of the literature on the toxicity of rare-earth metals as it pertains to the Engineering Demonstration System surrogate testing, 15:3792 (R;US)
Advanced fusion MHD power conversion using the CFAR [compact fusion advanced Rankine] cycle concept, 15:4444 (R;US)
Analyses of particles in beryllium by ion imaging, 15:2856 (R;US)
Application of the results of excavation response experiments at climax and the Colorado School of Mines to the development of an experiment for the underground research laboratory, 15:2237 (R;US)
Beryllium dispersion near explosive firing tables: A comparison of computed and observed results, 15:3468 (R;US)
Bounding dispersion analysis for rare-earth elements as it pertains to the Engineering Demonstration System surrogate testing, 15:3752 (R;US)
Burning rates of two cast nitramine explosives using a hybrid closed bomb-strand burner, 15:3382 (R;US)
Carbohydrate translocation and branch autonomy of Pinus ponderosa, 15:2309 (R;US)
Challenges in processing for polymer composites, 15:2988 (R;US)
Computer simulation of laser plasma interaction: Progress report for 1988, 15:4354 (R;US)
Concerning advanced architectures for strategic defense, 15:2802 (R;US)
Design and fabrication of the CPQ [Conductor Performance Qualification] coil, 15:4446 (R;US)
Design of a high-gain flux-compression generator, 15:4445 (R;US)
Effects of nitrogen pulsing on sputter-deposited beryllium films, 15:2855 (R;US)
Electron-positron momentum distribution measurements of high-T superconductors and related systems, 15:4258 (R;US)
Energy and Technology Review, October 1989, 15:4355 (R;US)
Environmental considerations for the conduct of surrogate tests in the Engineering Demonstration System, 15:3791 (R;US)
Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole, 15:3390 (R;US)
Evaluation of the post-emplacement environment of high level radioactive waste packages at Yucca Mountain, Nevada, 15:2239 (R;US)
First-principles interatomic potentials in transition metals: Multi-ion interactions and their analytic representation, 15:4236 (R;US)
Gels and foams from ultrahigh molecular weight polyethylene, 15:2986 (R;US)
High-power-density prime power systems: A literature search and analysis, 15:2581 (R;US)
Hugoniot measurements with the LLNL electric gun facility, 15:3221 (R;US)
Impact of a simulated nuclear winter environment on growth development and productivity of potatoes, winter wheat, pines and soybeans, 15:3489 (R;US)
In situ optical measurements of hydrofluoric acid aerosols, 15:3469 (R;US)
Induction linear accelerators for commercial photon irradiation processing, 15:3267 (R;US)
Inductive store opening switch and tests for energy transfer to a load, 15:3140 (R;US)
Interactive multidimensional data analysis and understanding, 15:4530 (R;US)
Interagency Nuclear Safety Review Panel: Safety evaluation report for Galileo: Volume 2, 15:2651 (R;US)
Intra-stark relaxation of Nd^{3+} in silicate glass: Subpicosecond accumulated photon echo experiments, 15:4237 (R;US)
Investigation of an electron beam evaporative source: Part 1, Theory; Part 2, Measurements, 15:3898 (R;US)
ITER [International Thermonuclear Experimental Reactor] in perspective, 15:4452 (R;US)
Kestrel 3 Program: Final report, 15:4488 (R;US)
Laboratory microfusion facility – Neutronics and radiological safety analysis, 15:4449 (R;US)
Laser glass (1989), 15:3168 (R;US)
More about breathing on the Mesa, 15:3516 (R;US)
MTX [Microwave Tokamak Experiment] diagnostic and auxiliary systems for confinement, transport, and plasma physics studies, 15:4352 (R;US)
Neutronics issues for starlight: An inertial confinement fusion reactor concept, 15:4447 (R;US)
NTES [Nuclear Test and Experimental Sciences Program] laser facility for physics experiments Building 391 High Bay Option, 15:4442 (R;US)
Optically based potassium sensor, 15:3372 (R;US)
PCP [Parallel C Preprocessor]: A parallel extension of C that is 99% fat free: Revision 1, 15:4531 (R;US)
Practical aspects of a 2-D edge-plasma model, 15:4450 (R;US)
Prospects for a soft x-ray FEL powered by a relativistic-klystron high-gradient accelerator (RK-HGA), 15:3167 (R;US)
Radiation damage and its influence on source requirements for high resolution x-ray holography, 15:3680 (R;US)
Relativistic cross sections for excitation of highly charged ions to specific magnetic sublevels by an electron beam, 15:3896 (R;US)
Relativistic distorted wave collision strengths and oscillator strengths for the 85 Li-like ions with $8 \leq Z \leq 92$, 15:3897 (R;US)
Relativistic extension of the electromagnetic direct implicit PIC algorithm, 15:4357 (R;US)
Results from heavy-ion bombardments of ^{254}Es, 15:4122 (R;US)
Safety evaluation report for Galileo: Volume 1, 15:2650 (R;US)
SBS [stimulated Brillouin scattering] pulse distortion in multimode optical fibers: Preliminary results, 15:4451 (R;US)
Structure of niobium carbides, 15:2934 (TJ;US)
Studies of polymer foam morphology with FIR [far-infrared radiation] laser scattering, 15:2987 (R;US)
The coupling of stimulated Raman and Brillouin scattering in a plasma, 15:4353 (R;US)
The degradation of natural resources in the Soviet Union, 15:3593 (R;US)
The EQ3/6 software package for geochemical modeling: Current status, 15:2238 (R;US)
The MTX [Microwave Tokamak Experiment] data acquisition system, 15:4358 (R;US)
Theory for high gain, high power free electron lasers: Final report, 15:3166 (R;US)
Time-dependent free convection in low Prandtl number fluids, 15:3207 (R;US)
UC accelerator mass spectrometry 1: Proceedings, 15:3364 (R;US)
Wall ablation, gas dynamics, and the history of wall stresses in ICF target chambers, 15:4448 (R;US)

Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry
Kinetics of coal conversion to soluble products: January 1, 1989–June 30, 1989, 15:2019 (R;US)
Kinetics of coal conversion to soluble products: Quarterly report, July 1, 1989–September 30, 1989, 15:2020 (R;US)

Liburdi Engineering Ltd., Hamilton, ON (Canada)
Gas turbine blade life assessment and repair guide: Final report, 15:2414 (R;US)

Lightwave Electronics Corp., Mountain View, CA (USA)
Efficient nonlinear conversion of laser-diode-pumped miniature solid-state laser sources. Final report, 1 May 1986-30 April 1989, 15:3144 (R;US)

Linfield Coll., McMinnville, OR (USA). Research Inst.
High-power-density prime power systems: A literature search and analysis, 15:2581 (R;US)

Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering
Industrial load management at Vaargaarda, 15:2641 (R;SE;In Swedish)
MINTOP industrial load management system, 15:2637 (R;SE;In Swedish)
Some heat transfer problems with phase change processes. Numerical and experimental analysis, 15:3191 (R;SE)

Lockheed Engineering and Sciences Co., Inc., Las Vegas, NV (USA)
Performance testing of Method 1312. QA (quality assurance) support for RCRA (Resource Conservation and Recovery Act) testing: Project report, 15:3583 (R;US)

Lodestar Research Corp., Boulder, CO (USA)
Fundamental studies of fusion plasmas: Annual performance report, 15:4307 (R;US)

Los Alamos National Lab., NM (USA)
A computer study of source-detector geometries proposed for the induced-emission tomography of transuranic elements, 15:3353 (R;US)
A cost effective battery bank for I^2t testing and evaluation of electrical switchgear, 15:4432 (R;US)
A high-speed beam of lithium droplets for collecting diverted energy and particles in ITER [International Thermonuclear Experimental Reactor], 15:4430 (R;US)
Analyses of transport in the upper soil layer and interpretation of caisson experiments, 15:2202 (R;US)
Analysis of caisson transport experiments by travel time approach, 15:2201 (R;US)
Analysis of physical training of security inspectors at Los Alamos National Laboratory: A preliminary report, 15:4487 (R;US)
Attempted use of zinc in vivo to protect against nitrogen mustard toxicity in tumor-free and in L1210 leukemia-bearing $B6D2F_1$ mice, 15:3764 (R;US)
Calculation of the production cross sections of high-spin isomeric states in hafnium, 15:4429 (R;US)
Compact rf-linac free-electron lasers, 15:3158 (R;US)
Cross sections and analyzing powers of $^{15}N(p,n)^{15}O$ at 200 MeV and 494 MeV, 15:4079 (R;US)
Design and performance of future KrF laser-fusion facilities, 15:4437 (R;US)
Fiber optic control and diagnostic family of hardwares for the Confinement Physics Research Facility (CPRF) toroidal field and dc interrupter systems, 15:4433 (R;US)
Fusion burn dynamics in dense Z-pinches (DZP), 15:4342 (R;US)
Hamiltonian chaos in a nonlinear polarized optical beam, 15:4285 (R;US)
High-field pulsed microwigglers, 15:3157 (R;US)
INEX [integrated numerical experiment] simulations of the Los Alamos HIBAF [high-brightness accelerator free-electron laser] free-electron laser MOPA [master oscillator power amplifier] experiment, 15:3298 (R;US)
Interpretation of recent LAMPF results on D T MU formation, 15:4073 (R;US)
Lasing on the third harmonic, 15:3156 (R;US)
Los Alamos Science: AIDS research, 15:3676 (R;US)
Magnetic ordering in $(Y_{1-x}Pr_x)Ba_2Cu_3O_7$ as evidenced by muon spin relaxation, 15:4256 (R;US)
Magnetic separation as a plutonium residue enrichment process, 15:2203 (R;US)
MCNP [Monte Carlo Neutron Photon] capabilities for nuclear well logging calculations, 15:3378 (R;US)
Measurements of plutonium residues from recovery processes, 15:2246 (R;US)
Microstructures of Y123 films on $SrTiO_3$, $LaGaO_3$ and $LaAlO_3$, 15:2922 (R;US)
Microwave characterization of high-temperature superconductors, 15:2921 (R;US)
Mixing of gases in large volumes by forced injection, 15:3155 (R;US)
Neutrino mass: Recent results, 15:3959 (R;US)
Optical design and performance of an XUV FEL [free-electron laser] oscillator, 15:3159 (R;US)
Optimization of the testing volumes with respect to neutron flux levels in the two-target high flux D-Li neutron source for the international fusion materials irradiation facility, 15:4435 (R;US)
Performance of the 10kV, 100-kA pulsed-power modules for the FRX-C magnetic compression experiment, 15:4428 (R;US)
Physics with ultra-low energy antiprotons, 15:4044 (R;US)
Pion induced double-charge exchange above the resonance, 15:4160 (R;US)
Possible FERMI liquid behavior of 5f electrons in UPt_3 at $T \gg T_K$, 15:4232 (R;US)
Preliminary integrated calculation of radionuclide cation and anion transport at Yucca Mountain using a geochemical model, 15:2204 (R;US)
Progress at LAMPF: Progress report, January–December 1988, 15:3946 (R;US)
Quality assurance and quality control for the compact physics research facility (CPRF) and ZTH experiment, 15:4431 (R;US)
Quality-assurance plan for the Basic Environmental Compliance and Monitoring Program (BECAMP), 15:3744 (R;US)
Report from the workshop on computing directions and options for data acquisition and analysis at LAMPF [Los Alamos Meson Physics Facility], 15:3297 (R;US)
Rf superconductivity research and development at Los Alamos National Laboratory, 15:3128 (R;US)
Strongly correlated quasi-one-dimensional bands: Ground states, optical absorption, and phonons, 15:4231 (R;US)
Symplectic numerical integration of Hamiltonian systems, 15:4286 (R;US)
Testing of a 50 kA, 50 kV current interrupter with I^2t preheating and long recovery voltage, 15:4436 (R;US)
The continuing saga of alpha CAM [continuous air monitor] development at Los Alamos, 15:3482 (R;US)
The design and performance of the FNAL high-energy polarized beam facility, 15:3271 (R;US)
The TITAN Reversed-Field Pinch fusion reactor study: Collection of papers, 15:4443 (R;US)
Theory of harmonic radiation using a single-electron source model, 15:3160 (R;US)
Transportation of a 451 ton generator stator and a 234 ton generator rotor from Hartsville, TN, to Los Alamos, NM, 15:4434 (R;US)

Louisiana Gasification Technology, Inc., Plaquemine, LA (USA)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1986. Report for 1 January-31 March 1986, 15:2031 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1986. Report for 1 April-30 June 1986, 15:2032 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1986. Report for 1 July-30 September 1986, 15:2033 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1986. Report for 1 October-31 December 1986, 15:2034 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1987. Report for 1 January-31 March 1987, 15:2035 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1987. Report for 1 April-30 June 1987, 15:2036 (R;US)
Environmental Monitoring plan for the Dow Syngas Project. Quarterly report: Third quarter, 1987. Report for 1 July-30 September 1987, 15:2037 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1987. Report for 1 October-31 December 1987, 15:2038 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1987. Report for 1 January-31 December 1987, 15:2039 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1988. Report for 1 April-30 June 1988, 15:2040 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1988. Report for 1 July-30 September 1988, 15:2041 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2042 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual report. Report for 1 April 1988-31 March 1989, 15:2043 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1989. Report for 1 April-30 June 1989, 15:2044 (R;US)

Louisiana State Univ., Baton Rouge, LA (USA)
Research in elementary particle physics: Progress report, March 1, 1989–February 28, 1990, 15:3944 (R;US)

Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Chemical Engineering
Molecular dynamics studies of aromatic hydrocarbon liquids: Progress report, March 1, 1989–February 28, 1990, 15:4211 (R;US)

Lund Univ. (Sweden)
Beam propagation, 15:3992 (R;SE)

Lydteknisk Inst., Taastrup (Denmark)
Noise from larger windmills. Principles for the construction of windmills that produce less noise, 15:2380 (R;DK;In Danish)

M

Martin Marietta Energy Systems, Inc., Piketon, OH (USA)
Power circuit breaker test system, 15:2419 (R;US)

Maryland Power Plant Research Program, Annapolis, MD (USA)
Environmental radionuclide concentrations in the vicinity of the peach bottom atomic power station: 1985-1986. Data report, 15:2456 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Chemical Engineering
Electrostatic precipitation of charged particles from a turbulent flow between coaxial cylinders, 15:3402 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Lab. for Computer Science
Implementation indices (1975-1979). Volume 1. Technical report, 15:4497 (R;US)

Massachusetts Inst. of Tech., Lexington, MA (USA). Lincoln Lab.
300-Watt dye laser for field experimental site, 15:3143 (R;US)
Binary micro optics: An application to beam steering, 15:3148 (R;US)
Noise levels in a tunable CO_2 laser source, 15:3147 (R;US)
Plasma-activated ion-beam reactive sputtering of NbN thin films, 15:2898 (R;US)
Tracking performance evaluation. Final report, 1 December 1987-31 August 1988, 15:3379 (R;US)

Massey (Barbara M.), Long Beach, CA (USA)
The ecology of riparian habitats of the southern California coastal region: A community profile, 15:3538 (R;US)

Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)
Max-Planck-Institute for Nuclear Physics. Annual report 1987, 15:4065 (R;DE;In German)

Max-Planck-Institut fuer Strahlenchemie, Muelheim an der Ruhr (Germany, F.R.)
Free-radical- and radiation-induced damage to DNA, 15:3699 (R;DE)

Michigan Technological Univ., Houghton, MI (USA)
Nuclear magnetic resonance imaging as a tool to characterize defect densities in solids, 15:4201 (R;US)

Michigan Univ., Ann Arbor, MI (USA). Div. of Nuclear Medicine
New techniques for positron emission tomography in the study of human neurological disorders: Progress report, June 15, 1987–November 15, 1989, 15:3616 (R;US)

Microelectronics Center of North Carolina, Research Triangle Park, NC (USA)
Effects of normal annealing cycles during IGFET fabrication on initial and radiation-induced gate-insulator defects. Annual progress report, 1 December 1988-7 July 1989, 15:3328 (R;US)

Midwest Research Inst., Cary, NC (USA)
Evaluation of emission sources from creosote wood-treatment operations. Final report, 15:2747 (R;US)

Miljoestyrelsen, Roskilde (Denmark). Luftforureningslab.
Calculation of air pollution dispersion over a complex terrain with special emphasis on dimensioning of chimney stacks, 15:3420 (R;DK;In Danish)

Minerals Management Service, Herndon, VA (USA)
Effects of wind and Gulf Stream events on the currents off the coast of North Carolina as it relates to oil-spill risk potential, 15:2128 (R;US)
Federal offshore statistics, 1987: Leasing exploration, production, and revenues, 15:2106 (R;US)

Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)
Noise pollution abatement for heat pumps with internal combustion engines. Illustrated by the large-capacity gas-fueled heat pumps in domestic and commercial buildings, 15:2675 (R;DE;In German)

Ministerium fuer Wirtschaft, Mittelstand und Technologie des Landes Baden-Wuerttemberg, Stuttgart (Germany, F.R.)
Energy report 1987/88, 15:2590 (R;DE;In German)

Minnesota Univ., Minneapolis, MN (USA). Corrosion Research Center
Cell performance of ultra-thin polymer-cathode system: Theoretical energy and power-density projections. Technical report No. 3, July 1988-June 1989, 15:2568 (R;US)
Lithium-polymer-electrolyte battery: Electrochemical behavior of cathode materials. Technical report, July 1988-June 1989, 15:2567 (R;US)
Use of lithium batteries in biomedical devices. Technical report No. 8, July 1988-June 1989, 15:2569 (R;US)

Minnesota Univ., Minneapolis, MN (USA). Dept. of Aerospace Engineering and Mechanics
Lubricated pipelining: Stability of core-annular flow, 15:2134 (R;US)

Minnesota Univ., Minneapolis, MN (USA). Dept. of Chemical Engineering and Materials Science
Impedance analysis of ionic transport in polypyrrole-polyazulene copolymer and its charge-discharge characteristics. Technical report, July 1988-June 1989, 15:2571 (R;US)
Rechargeable lithium/polymer cathode batteries. Technical report, July 1988-June 1989, 15:2570 (R;US)

Minnesota Univ., Minneapolis, MN (USA). Dept. of Civil and Mineral Engineering
Removal of oil from oil-water mixtures using selective oil filtration. Masters thesis, 15:2132 (R;US)

Minnesota Univ., Minneapolis, MN (USA). Dept. of Physics and Astronomy
Nuclear structure studies at intermediate energies: Interim progress report, 1988–89: September 1988–August 1989, 15:4064 (R;US)

Minskij Meditsinskij Inst., Minsk (Byelorussian SSR)
Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports, 15:3625 (R;SU;In Russian)

Mission Research Corp., Albuquerque, NM (USA)
Single fluid simulations of plasma openings switch behavior, 15:3308 (R;US)

Mitsubishi Heavy Industries Ltd., Tokyo (Japan)
Development of high-efficiency scroll compressors for air conditioners, 15:2695 (R;JP)

MK-Ferguson Co., St. Charles, MO (USA)
Phase 1 spring and seep report: Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri: Revision 0, 15:2242 (R;US)

Montana Dept. of Fish, Wildlife and Parks, Kalispell, MT (USA)
Quantification of Hungry Horse Reservoir water level needed to maintain or enhance reservoir fisheries: Methods and data summary, 1983–1987, 15:2278 (R;US)

Montana State Univ., Bozeman, MT (USA). Dept. of Electrical Engineering
Computer controlled MHD power consolidation and pulse-generation system: Technical progress report, October 1988–March 1989, 15:2648 (R;US)

Muenchen Univ. (Germany, F.R.). Fakultaet fuer Geowissenschaften
Distribution of heavy metals and anions in the groundwater of quaternary gravel deposits in the Munich area (Dornach). Laboratory and field test results, 15:3540 (R;DE;In German)

Muenchen Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie
Studies of the ternary phase diagram U-Pu-O between 1000 and 2000deg C. Structural and physico-chemical properties of $Pu_xU_yO_z$ mixed oxides with a view to applications as fuel, 15:2919 (R;DE;In German)

Muenchen Univ. (Germany, F.R.). Meteorologisches Inst.
Estimation of aerosol absorption from measurements of intensity and polarization of the sky radiation at Tsumeb (Namibia). Final report, 15:2291 (R;DE;In German)

N

Nagoya Univ. (Japan). Inst. of Plasma Physics
Development of Fusion and Plasma Diagnostics Center - synchrotron radiation experiment, (2). Characterization of primary monochromator and construction of calibration apparatus and its application, 15:4318 (R;JP;In Japanese)
Measurements of environmental radiations and radioactivities in Toki, 5, 15:3476 (R;JP;In Japanese)
Measurements of environmental radiations and radioactivities in Toki, 6, 15:3477 (R;JP;In Japanese)
Proceedings of the Japan-U.S. workshop P-118 on vacuum technologies for fusion devices, 15:4419 (R;JP)
Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, 15:4319 (R;JP)

National Academy of Sciences, Washington, DC (USA). Commission on Physical Sciences, Mathematics, and Resources
Ozone depletion, greenhouse gases, and climate change, 15:3429 (R;US)

National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center
Calculation of turbulence-driven secondary motion in ducts with arbitrary cross section, 15:3206 (R;US)
Computational simulation of high temperature metal matrix composites cyclic behavior, 15:2976 (R;US)
Development and refinement of test bed simulations, 15:2416 (R;US)
Fatigue crack growth study of SCS6/Ti-15-3 composite, 15:2974 (R;US)
Ion beam and plasma methods of producing diamondlike carbon films, 15:2929 (R;US)
Lunar production of solar cells, 15:2295 (R;US)
Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)
NASA advanced space photovoltaic technology-status, potential and future mission applications, 15:2296 (R;US)
Optimum interface properties for metal matrix composites, 15:2975 (R;US)
Probabilistic structural analysis methods of hot engine structures, 15:3248 (R;US)
Sliding seal materials for low heat rejection engines, 15:2783 (R;US)
Solar radiation on Mars, 15:2292 (R;US)
Turbine Engine Hot Section Technology, 1987, 15:3236 (R;US)

National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center
Fracture toughness of SiC/Al metal matrix composite, 15:2973 (R;US)

National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center
Research and technology plans for FY 1989 and accomplishments for FY 1988, 15:2977 (R;US)

National Aeronautics and Space Administration, Washington, DC (USA)
Time-variable phenomena in the Jovian system, 15:3867 (R;US)

National Aerospace Lab., Chofu, Tokyo (Japan)
Spectral characteristics of arc-heated low density plasma flows (3). Helium plasma, 15:3892 (R;JP;In Japanese)

National Bureau of Standards, Washington, DC (USA). Chemical Kinetics Div.
Kinetics data base for combustion modeling: Status report, February 1, 1988–January 31, 1989, 15:3107 (R;US)

National Center for Atmospheric Research, Boulder, CO (USA)
Global tropospheric chemistry: Chemical fluxes in the global atmosphere, 15:3393 (R;US)

National Center for Earthquake Engineering Research, Buffalo, NY (USA)
Liquefaction hazards and their effects on buried pipelines. Technical report, 15:3254 (R;US)

National Coal Association, Washington, DC (USA)
1988 interorganizational workshop on future utility SO_2 emissions, 15:2078 (R;US)

National Council on Radiation Protection and Measurements, Bethesda, MD (USA)
Control of radon in houses, 15:2692 (R;US)

National Effluent Toxicity Assessment Center, Duluth, MN (USA)
Methods for aquatic toxicity-identification evaluations. Phase 3. Toxicity confirmation procedures. Technical report, 15:3549 (R;US)
Methods for aquatic toxicity-identification evaluations. Phase 2. Toxicity identification procedures. Technical report, 15:3550 (R;US)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)
Health-hazard evaluation report HETA 87-109-1950, North Riverside Fire Department, North Riverside, Illinois, 15:3458 (R;US)
Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados, 15:3459 (R;US)
Indoor air quality: Selected references, 15:3448 (R;US)
Registry of Toxic Effects of Chemical Substances (RTECS), 1988 computer tape. Data file, 15:3790 (R;US)
Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey, 15:3456 (R;US)
Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication, 15:3684 (R;US)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering
Detailed control technology survey of a coke-oven plant, 15:2050 (R;US)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Industrial Hygiene Section
In-depth industrial-hygiene survey report on styrene exposure at Fiberform, Spokane, Washington, January 16-18, 1979, 15:3433 (R;US)
In-depth industrial-hygiene survey report on styrene exposure at Larson Industries, Incorporated Boat Plant, Little Falls, Minnesota, February 27-March 1, 1979, 15:3434 (R;US)

National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)
Ambient and high-temperature calorimetry of commercial surfactants: Project BE4A, Milestone 8, FY89 annual research plan, 15:2113 (R;US)
Selection of an effective biocide and toxicity evaluation for a specific MEOR [microbial enhanced oil recovery] microbial formulation, 15:2114 (R;US)
Use of amine oxide surfactants for chemical flooding EOR [enhanced oil recovery], 15:2112 (R;US)

National Inst. of Radiological Sciences, Chiba (Japan)
Dynamic aspects of radioactive contamination of marine organisms. Proceeding of the 14th NIRS seminar on environmental research, 15:3570 (R;JP;In Japanese)
Report of radioactivity survey research in fiscal year 1987, 15:4194 (R;JP;In Japanese)

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (USA)
Computer-controlled test system for operating different wear-test machines, 15:3216 (R;US)

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD (USA). Office of Nondestructive Evaluation
NDE (non-destructive evaluation) publications, 1985, 15:3217 (R;US)

National Inst. of Standards and Technology (NCTL), Gaithersburg, MD (USA)
Workshop on cement stabilization of low-level radioactive waste: Proceedings, 15:2214 (R;US)

National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Building Environment Div.
Method for measuring the effectiveness of gaseous-contaminant removal filters, 15:3257 (R;US)

National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Electronics and Electrical Engineering
Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering center programs, January-March 1989, with 1989 CEEE events calendar, 15:3133 (R;US)

National Inst. of Standards and Technology, Boulder, CO (USA). Thermophysics Div.
Tables for the thermophysical properties of methane. Technical note, 15:2151 (R;US)

National Inst. of Standards and Technology, Gaithersburg, MD (USA)
Service life of concrete, 15:2219 (R;US)

National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.
Use of a fish transportation barge for increasing returns of steelhead imprinted for homing: Final report, 15:2280 (R;US)

National Radiological Protection Board, Chilton (UK)
Investigations of iodine-129 in the natural environment: results and implications, 15:2241 (R;GB)

National Research Council, Washington, DC (USA). Transportation Research Board
HRIS (Highway Research Information Service) Abstracts. Volume 21, Number 4 - Winter 1988, 15:2713 (R;US)

National Science Foundation, Washington, DC (USA). Div. of Science Resources Studies
Biotechnology research and development activities in industry: 1984 and 1985. Surveys of Science Resources series, 15:3604 (R;US)

National Swedish Environmental Protection Board, Solna (Sweden)
Experiences of DOAS technique for flue gas measurements, 15:3467 (R;SE;In Swedish)
Mercury in lake fish. Linkages to mercury and selenium in mor and historical emissions, 15:3565 (R;SE;In Swedish)

National Technical Information Service, Springfield, VA (USA)
Asbestos and silicate pollution in the work place. January 1978-July 1989 (Citations from Pollution Abstracts). Report for January 1978-July 1989, 15:3461 (R;US)
Cellulose and lignin: Biodegradation. June 1987-September 1989 (Citations from the Life Sciences Collection data base). Report for June 1987-September 1989, 15:2300 (R;US)
Computer systems protection: Uninterruptible power supplies. January 1983-September 1989 (Citations from the Computer data base). Report for January 1983-September 1989, 15:4523 (R;US)
Corrosion-resistant coatings. February 1983-September 1989 (Citations from the NTIS data base). Report for February 1983-September 1989, 15:2848 (R;US)
Environmental impacts: Computer analysis. January 1970-September 1988 (Citations from the NTIS data base). Report for January 1970-September 1988, 15:2596 (R;US)
Environmental impacts: Computer analysis. October 1988-September 1989 (Citations from the NTIS data base). Report for October 1988-September 1989, 15:2597 (R;US)
Excimer lasers: Applied research and commercial development. January 1980-September 1989 (Citations from the Searchable Physics Information Notices data base). Report for January 1980-September 1989, 15:3165 (R;US)
Fire-extinguishing agents. January 1970-September 1989 (Citations from the COMPENDEX data base). Report for January 1970-September 1989, 15:2982 (R;US)
Food and grain preservation through irradiation. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 15:3688 (R;US)
Hazardous-materials transportation. September 1982-September 1989 (Citations from the COMPENDEX data base). Report for September 1982-September 1989, 15:2715 (R;US)
Heavy metals in drinking water: Standards, sources, and effects. January 1978-September 1989 (Citations from the Life Sciences Collection data base). Report for January 1978-September 1989, 15:3564 (R;US)
Hydrodynamic journal bearings: Capacity, wear, and lubrication. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989, 15:3134 (R;US)
Incineration studies. October 1985-September 1989 (Citations from the COMPENDEX data base). Report for October 1985-September 1989, 15:2778 (R;US)
Inland wetlands legislation and management. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3592 (R;US)
Lightning, surge, and transient protection. December 1982-September 1989 (Citations from the NTIS data base). Report for December 1982-September 1989, 15:2433 (R;US)
Lithium batteries. October 1987-September 1989 (Citations from the COMPENDEX data base). Report for October 1987-September 1989, 15:2580 (R;US)
Lubricants and greases: Properties and evaluation. January 1973-April 1988 (Citations from Fluidex data base). Report for January 1973-April 1988, 15:3135 (R;US)
Lubricants and greases: Properties and evaluation. May 1988-September 1989 (Citations from Fluidex data base). Report for May 1988-September 1989, 15:3136 (R;US)
Lubrication for high and extreme pressures. January 1974-September 1989 (Citations from Fluidex data base). Report for January 1974-September 1989, 15:3218 (R;US)
Lubrication for high and extreme pressures. January 1971-September 1989 (Citations from the US Patent data base). Report for January 1971-September 1989, 15:3219 (R;US)
Membrane gas separation. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3065 (R;US)
National Institute for Occupational Safety and Health (NIOSH): Health Hazard Evaluation Reports. January 1987-September 1989 (Citations from the NTIS data base). Report for January 1987-September 1989, 15:3685 (R;US)
Nuclear power plant decommissioning. January 1972-September 1989 (Citations from the NTIS data base). Report for January 1972-September 1989, 15:2469 (R;US)
Nuclear reactor accidents: Chernobyl, TMI (Three Mile Island), and Windscale. January 1974-September 1989 (Citations from Pollution Abstracts). Report for January 1974-September 1989, 15:2554 (R;US)
Oil-spill removal techniques and equipment. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989, 15:2133 (R;US)
Plastics and elastomers: Radiation crosslinking. April 1986-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for April 1986-September 1989, 15:2981 (R;US)
Pulping effluents: Biological treatment. January 1976-September 1989 (Citations from the Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989, 15:2752 (R;US)
Radioactive waste storage sites: Reclamation and remedial action. January 1970-July 1989 (Citations from the NTIS data base). Report for January 1970-July 1989, 15:2221 (R;US)
Semiconductor gas sensors. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989, 15:3370 (R;US)
Sialon ceramics. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989, 15:2933 (R;US)
Sol-gel processes. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:2222 (R;US)
Thermal energy storage. July 1987-September 1989 (Citations from the NTIS data base). Report for July 1987-September 1989, 15:2566 (R;US)
Toxicity: Polymeric materials in food-contact applications. January 1977-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1977-September 1989, 15:3789 (R;US)
Tungsten and tungsten-alloy powder metallurgy: Powder production and applications-excluding lamps. November 1971-July 1989 (Citations from the US Patent data base). Report for November 1971-July 1989, 15:2847 (R;US)

Wastepaper recycling. January 1976-September 1989 (Citations from the Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989, 15:2751 (R;US)

Wastewater treatment: Chemical industry. January 1970-September 1989 (Citations from Pollution Abstracts). Report for January 1970-September 1989, 15:3563 (R;US)

Water treatment: Air stripping. December 1981-July 1989 (Citations from the Selected Water Resources Abstracts data base). Report for December 1981-July 1989, 15:3562 (R;US)

National Wetlands Research Center, Slidell, LA (USA)

The ecology of riparian habitats of the southern California coastal region: A community profile, 15:3538 (R;US)

Naval Medical Research Inst., Bethesda, MD (USA)

Robust spatial calibration of a planar positron camera. Final report, October 1985-September 1987, 15:3614 (R;US)

Naval Postgraduate School, Monterey, CA (USA)

Analysis of forest-fire smoke using satellite imagery. Master's thesis, 15:3384 (R;US)

Origin of the universe from Quantum Chaos: An introduction to current ideas (professor John Dyer Memorial Lecture). Technical report, 15:3820 (R;US)

Naval Research Lab., Washington, DC (USA)

Eye/sensor protection against laser irradiation: Organic nonlinear optical materials. Final report, April-December 1988, 15:3798 (R;US)

High-efficiency fast-neutron detector. Memorandum report, 15:3329 (R;US)

Numerical simulation of the compressible Orszag-Tang vortex. Interim report, June 1988-February 1989, 15:3935 (R;US)

Naval Surface Warfare Center, Silver Spring, MD (USA)

Battery actuation of NITINOL at sub-zero temperatures, 15:2572 (R;US)

Nebraska Univ., Lincoln, NE (USA). Dept. of Physics

Theory of RBE: Annual progress report, January 1, 1989–December 31, 1989, 15:3617 (R;US)

Netherlands Energy Research Foundation, Petten (Netherlands)

Experiences with the application of a solar boiler on a camping-site in Sint Maartenszee, Netherlands, 15:2333 (R;NL;In (In Dutch))

Mineral matter transformations and slagging in a semi-industrial furnace, 15:2100 (R;NL)

Review on mineral matter transformations and slagging in pulverized coal combustion, 15:2099 (R;NL)

Nevada Univ., Las Vegas, NV (USA). Environmental Research Center

Bench-scale fixation of soils from the Tacoma Tar Pits Superfund Site. Final report, 15:3521 (R;US)

New Mexico Energy and Minerals Dept., Santa Fe, NM (USA)

Developmental state programm for institutional conservation: Executive summary: Final technical report, October 1, 1986–September 30, 1988, 15:2621 (R;US)

New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center

Rock matrix and fracture analysis of flow in western tight gas sands: 1988 annual report (Phase 4). Report for 30 December 1987-31 March 1989, 15:2146 (R;US)

New Mexico State Univ., Las Cruces, NM (USA)

Soil physical properties at the Las Cruces trench site, 15:2218 (R;US)

New Mexico Univ., Albuquerque, NM (USA). Dept. of Chemistry

Electrochemical characterization and derivatization of coal: Final technical report, September 15, 1986–September 14, 1989, 15:2059 (R;US)

New York Univ., NY (USA)

Advanced toroidal theory: Progress report, 15:4306 (R;US)

Interactions of carcinogens with DNA [deoxyribonucleic acid]: Final progress report, July 1, 1987–July 31, 1989, 15:3760 (R;US)

New York Univ., NY (USA). Courant Inst. of Mathematical Sciences

Uncertainties associated with extrapolating L mode energy confinement to ITER and CIT, 15:4305 (R;US)

New York Univ., NY (USA). Dept. of Environmental Medicine

Cancer risk for radon exposure in a polluted environment: Progress report, March 1, 1989–February 28, 1990, 15:3413 (R;US)

Lung cancer risk from inhalation of radon and other pollutants in rats: Comprehensive progress report, March 1, 1987–February 28, 1990, 15:3412 (R;US)

Niedersaechsische Forstliche Versuchsanstalt, Goettingen (Germany, F.R.)

Effects of acid and lime on mesofauna of forest soils in the laboratory and in the field. Final report, 15:3762 (R;DE;In German)

Niedersaechsisches Inst. fuer Radiooekologie (Germany, F.R.)

HTO deposition through gas exchange between soil and atmosphere, 15:3507 (R;DE;In German)

Nippon Steel Corp., Sagamihara, Kanagawa (Japan)

Effects of environmental variables on fatigue crack growth rate in steel immersed in seawater, 15:2826 (R;JP)

Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark)

Development of a container for pumps, measuring equipment and motorgenerators in connection with a bioconversion energy system, 15:2297 (R;DK;In Danish)

Norfolk State Univ., VA (USA)

Research, development, training, and education using the Ada programming language. Final report, 1 September 1987-31 May 1989, 15:4503 (R;US)

Norsk Inst. for Luftforskning, Lillestroem (Norway)

NO_X emissions from stationary sources in eastern Europe, 15:3421 (R;NO)

North American Electric Reliability Council, Princeton, NJ (USA)

1989 reliability assessment: The future of bulk electric system reliability in North America, 1989–1998, 15:2639 (R;US)

North Carolina State Univ., Raleigh, NC (USA)

Effects of acid deposition on painted wood substrates, 15:3432 (R;US)

North Dakota Univ., Grand Forks, ND (USA). Dept. of Physics

Role of porosity in supercritical fluid extraction of coal: Final technical report, 15:2060 (R;US)

North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center

Test plan for valveless ash removal from pressurized fluid bed combustion systems, 15:2095 (R;US)

NSI Technology Services Corp., Corvallis, OR (USA)

Geographic information system documentation of watershed data for Direct/Delayed Response Project. Southern Blue Ridge Province data base, 15:3553 (R;US)

Geographic information system documentation of watershed data for Direct/Delayed Response Project. Northeast data base, 15:3555 (R;US)

Nuclear Energy Agency, 75 - Paris (France)

Data for decay Heat Predictions Proceedings of a specialists' meeting, 15:4121 (R;FR)

Nuclear Energy Agency, 75 - Paris (France). Nuclear Data Committee

Annual progress report on nuclear data 1987, 15:4193 (R;FR)

Nuclear Regulatory Commission, Washington, DC (USA)

NRC regulatory information conference: Proceedings: Volume 1, 15:2538 (R;US)

Workshop on cement stabilization of low-level radioactive waste: Proceedings, 15:2214 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Computer and Telecommunications Services

Population dose commitments due to radioactive releases from nuclear power plant sites in 1986, 15:2539 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering

Evaluation of hypotheses for the cause of the 1886 Charleston earthquake: Final report, 15:3813 (R;US)

Near-surface neotectonic deformation associated with seismicity in the northeastern United States, 15:3814 (R;US)

Service life of concrete, 15:2219 (R;US)

Soil physical properties at the Las Cruces trench site, 15:2218 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and Systems Technology

PLOTnFIT: A BASIC program for data plotting and curve fitting, 15:4522 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services
NRC Regulatory Agenda: Quarterly report, July–September 1989, 15:2468 (R;US)
Title list of documents made publicly available, July 1–31, 1989, 15:2466 (R;US)
Title list of documents made publicly available, August 1–31, 1989: Volume 2, No. 8, 15:2467 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of High-Level Waste Management
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1, 15:2215 (R;US)
FLAC (Fast Lagrangian Analysis of Continua), Version 2.20: User's manual, 15:2216 (R;US)
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Verification, example and benchmark problems: Volume 3, 15:2217 (R;US)
UDEC (Universal Distinct Element Code) version ICG1.5: User's manual: Volume 2, 15:3816 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Low-Level Waste Management and Decommissioning
Standard Review Plan for a petition for rulemaking on radioactive waste streams below regulatory concern: Expedited review in accordance with Appendix B to 10 CFR, Part 2: Data report for comment, 15:2213 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Assessment
Closeout of IE Bulletin 86-02: Static "O" ring differential pressure switches, 15:2545 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Operational Events Assessment
Closeout of IE Bulletin 86-01: Minimum flow logic problems that could disable residual heat removal pumps: Minimum flow logic problems that could disable residual heat removal pumps, 15:2544 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications
Radiation-related impacts for nuclear plant physical modifications: Final report, 15:2543 (R;US)
Summary of advanced LMR [Liquid Metal Reactor] evaluations: PRISM [Power Reactor Inherently Safe Module] and SAFR [Sodium Advanced Fast Reactor], 15:2546 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safeguards and Transportation
Directory of certificates of compliance for radioactive materials packages: Report of NRC approved packages: Volume 1, Revision 12, 15:2173 (R;US)
Directory of certificates of compliance for radioactive materials packages: Certificates of compliance: Volume 2, Revision 12, 15:2174 (R;US)
Directory of certificates of compliance for radioactive materials packages: Report of NRC approved quality assurance programs for radioactive materials packages: Volume 3: Revision 9, 15:3132 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution
An overview of BWR Mark-I containment venting risk implications, 15:2542 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research
A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation, 15:2541 (R;US)
Human Factors Regulatory Research Program Plan, FY 1989–FY 1992: Volume 1, 15:2537 (R;US)
Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4, 15:2547 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
Multiloop integral system test (MIST): Test Group 35, Noncondensibles and venting: Final report: Volume 7, 15:2549 (R;US)
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Information Resources Management
Radioactive materials released from nuclear power plants: Annual report, 1987, 15:2540 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation
Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446): Supplement, 15:3594 (R;US)
Safety evaluation report on Tennessee Valley Authority: Browns Ferry nuclear performance plan: Browns Ferry Unit 2 restart: Volume 3, Supplement 1, 15:2536 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research
Assessment of RELAP5/MOD2, Cycle 36.04 against FIX-II split break experiment No. 3051, 15:2552 (R;US)
Review of LOFT [Loss-of-Fluid Test] large break experiments: OECD LOFT project, 15:2551 (R;US)

Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.)
Corrosion database for the nuclear fuel cycle. Sub-project no. 1. Final report, 15:4544 (R;DE;In German)

O

Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div.
Uranium enrichment export control guide: Gaseous diffusion, 15:2249 (R;US)

Oak Ridge National Lab., TN (USA)
A computer-controlled automated test system for fatigue and fracture testing, 15:3215 (R;US)
A semiautomated computer-interactive dynamic impact testing system, 15:4397 (R;US)
Acceleration of small, light projectiles (including hydrogen isotopes) to high speeds using a two-stage light gas gun, 15:4396 (R;US)
Aging assessment of auxiliary feedwater systems, 15:2511 (R;US)
Alpha modification of Tokamak ballooning instabilities, 15:4304 (R;US)
An assessment of the lifetime of Faraday shield elements, 15:4392 (R;US)
Applied exposure modeling for residual radioactivity and release criteria, 15:3693 (R;US)
Biological (molecular and cellular) markers of toxicity: Semi-annual technical progress report (No. 2), April 1, 1989–September 30, 1989, 15:3765 (R;US)
Business communications, 15:4536 (R;US)
Chlorine related degradation of materials in coal liquefaction, 15:2018 (R;US)
Comparison of advanced power generation technologies using computer simulations, 15:2409 (R;US)
Disasters and market response: An economists perspective on the management of urban emergencies, 15:2593 (R;US)
Effect of gaseous corrosion on the strength of SiC and Si_3N_4, 15:2912 (R;US)
Engineering approaches to the application of fracture toughness data in the nuclear industry, 15:2820 (R;US)
Equilibrium shape control in CIT [Compact Ignition Tokamak] PF [poloidal field] design, 15:4391 (R;US)
Evaluation of check valve monitoring methods, 15:2479 (R;US)
Graphite as a plasma-facing material in fusion experiments, 15:4389 (R;US)
Guidelines for a "good" integrated resource plan, 15:2632 (R;US)
High-temperature corrosion of heat exchanger materials, 15:2911 (R;US)
Horizontal cold source friction losses of D_2 model with coaxial tubes comparison of calculated values with experimental results in D_2, 15:2259 (TG;US)
Horizontal cold source friction losses of D_2 model with separate tubes comparison of calculated values to experimental results in D_2, 15:2473 (TG;US)

Horizontal cold source: Fluid dynamics tests on the moderator model in water and air current, 15:2472 (TG;US)
How would you know an intelligent system if you saw one?, 15:4511 (R;US)
Human factors survey of advanced instrumentation and controls, 15:2437 (R;US)
Investigation of radon entry and effectiveness of mitigation measures in seven houses in New Jersey, 15:2693 (R;US)
ISIS: An Interactive System for Instruction and Sampling, 15:3483 (R;US)
ITER disruption modeling using TSC [Tokamak Simulation Code], 15:4301 (R;US)
Job/task analysis for I&C [Instrumentation and Controls] instrument technicians at the High Flux Isotope Reactor, 15:2492 (R;US)
Location and repair of air leaks in the ATF [Advanced Toroidal Facility] vacuum vessel, 15:4390 (R;US)
Molecular clustering in supercritical solutions, 15:3073 (R;US)
Navy Radon Assessment and Mitigation Program progress report, September 1988–May 1989, 15:2673 (R;US)
Nondestructive assay and nondestructive examination of remote-handled transuranic waste at the ORNL waste handling and packaging plant, 15:2181 (R;US)
Numerical and empirical verification of the stress state in a ceramic, button-head, tensile specimen, 15:2913 (R;US)
ORNL [Oak Ridge National Laboratory] 89, 15:2610 (R;US)
Potential minimum cost of electricity of superconducting coil tokamak power reactors, 15:4395 (R;US)
Power reactor embrittlement data base, 15:2510 (R;US)
Preliminary design of the CIT [Compact Ignition Tokamak] cryostat, 15:4394 (R;US)
Radionuclide deposition and exposure in the Federal Republic of Germany after the Chernobyl accident, 15:3746 (R;US)
Red spruce decline—Winter injury and air pollutants, 15:3427 (R;US)
Results of the independent verification of radiological remedial action at 381 East 3rd South Street, Monticello, Utah (MS00140), 15:3511 (R;US)
Results of the independent verification of radiological remedial action at 98 East 5th South Street, Monticello, Utah (MS00076), 15:3512 (R;US)
Results of the independent verification of radiological remedial action at 196 East 3rd South Street, Monticello, Utah (MS00083), 15:3513 (R;US)
Results of the independent verification of radiological remedial action at 384 South 2nd East Street, Monticello, Utah (MS00084), 15:3514 (R;US)
Results of the Manipulator Test Test Stand study: Comparison of manipulators and evaluation of equipment items, 15:2170 (R;US)
Results of the radiological survey at 9 Hancock Street, Lodi, New Jersey (LJ028), 15:3508 (R;US)
Results of the radiological survey at 72 Sidney Stret, Lodi, New Jersey (LJ067), 15:3509 (R;US)
Results of the radiological survey at 133 Maywood Avenue, Maywood, New Jersey (MJ025), 15:3510 (R;US)
Spin dynamics of amorphous $Fe_{90-x}Ni_xZr_{10}$, 15:2819 (R;US)
Structure of amorphous Al_2O_3 produced by ion implantation, 15:2908 (R;US)
Subcriticality of two uranyl nitrate slab tanks spaced in air by the ^{252}CF-source-driven noise analysis method, 15:3125 (R;US)
The development and revision of the Federal Radiological Emergency Response Plan, 15:2512 (R;US)
The effects of annealing on the structure and distribution of charge states of iron implanted into α-Al_2O_3 at 77 K, 15:2907 (R;US)
The International Thermonuclear Experimental Reactor configuration evolution, 15:4387 (R;US)
The optical properties of beryllium, 15:2830 (R;US)
The ORNL plasma fueling program, 15:4388 (R;US)
The practice of utility least-cost planning: A report on a study-in-progress, 15:2633 (R;US)
The study of exotic N $\simeq$ 82 nuclei using the Daresbury recoil mass separator, 15:4101 (R;US)
Training waste generators: The first responder in proper waste management, 15:2184 (R;US)
[Ceramic powder processing]: Foreign trip report, October 7–15, 1988, 15:2930 (R;US)
[Coal science]: Foreign trip report, October 20, 1989–October 31, 1989, 15:2065 (R;US)
[Coal structure and basic reactions]: Foreign trip report, October 20, 1989–October 28, 1989, 15:2064 (R;US)
[Deposition of atmospheric nitrogen species to forests in North America and Europe]: Foreign trip report, September 24–October 11, 1989, 15:3422 (R;US)
[Discussions of global environmental problems]: Foreign trip report, October 14, 1989–October 21, 1989, 15:3426 (R;US)
[Dynamics of magnetic fluctuations in high-T_c materials]: Foreign trip report, October 5–October 15, 1989, 15:4257 (R;US)
[Ecosystem research on Walker Branch watershed]: Foreign trip report, October 22–28, 1989, 15:3499 (R;US)
[Emergency planning for technological and natural hazards]: Foreign trip report, October 1, 1989–October 15, 1989, 15:2594 (R;US)
[Environmental transport and health effects of radioactive materials]: Foreign trip report, September 16, 1989–October 7, 1989, 15:3747 (R;US)
[Fabrication of superconducting films]: Foreign trip report, September 23, 1989–October 11, 1989, 15:2931 (R;US)
[Graphite and carbon/carbon composition]: Foreign trip report, September 17, 1988–September 28, 1988, 15:2979 (R;US)
[Growth and physiology of red spruce in relationship to acidic deposition in the Great Smoky Mountains National Park, USA]: Foreign trip report, September 30, 1989–October 14, 1989, 15:3423 (R;US)
[Halden Reactor Project and DOE's Advanced Controls Program: Foreign trip report, October 16, 1989–October 22, 1989, 15:2481 (R;US)
[Immobilization of technetium in blast furnace slag]: Foreign trip report, October 13, 1989–October 30, 1989, 15:2220 (R;US)
[Integrity of pressure components of nuclear power plants]: Foreign trip report, October 3, 1989–October 20, 1989, 15:2553 (R;US)
[Safety related reactor physics calculation for HTGR type reactors]: Foreign trip report, October 3, 1989–October 7, 1989, 15:2455 (R;US)
[The cause of the glacial to interglacial atmospheric CO_2 change]: Foreign trip report, October 14, 1989–October 24, 1989, 15:3424 (R;US)
[The role of oceans in determining atmospheric CO_2]: Foreign trip report, October 14, 1989–October 22, 1989, 15:3425 (R;US)
[US Agency for International Development–Government of India collaborative coal projects]: Foreign trip report, October 21, 1989–November 2, 1989, 15:2429 (R;US)

Oak Ridge National Lab., TN (USA). Hazwrap Support Contractor Office
Development of a centralized solvent recovery system at Carswell Air Force Base, 15:3801 (R;US)

Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. (Austria)
Review of LOFT [Loss-of-Fluid Test] large break experiments: OECD LOFT project, 15:2551 (R;US)

Office of Radiation Programs, Washington, DC (USA)
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)
Indoor radon and radon-decay product measurement protocols, 15:3487 (R;US)

Office of the Deputy Under Secretary of Defense for Policy, Washington, DC (USA)
Hostile intelligence threat: US technology, 15:2611 (R;US)

Oklahoma Univ., Norman, OK (USA). Dept. of Botany and Microbiology
Molecular biology and physiology of methanogenic archaebacteria. Annual report, July 1988-June 1989, 15:3596 (R;US)

Old Dominion Univ., Norfolk, VA (USA)
Nuclear fragmentation energy and momentum transfer distributions in relativistic heavy-ion collisions. Progress report, period ended 30 June 1989, 15:4163 (R;US)

Old Dominion Univ., Norfolk, VA (USA). Research Foundation
Boundary processes in the nutrient-bearing stratum of the North Atlantic: Progress report, March 1, 1989–February 28, 1990, 15:3818 (R;US)

Ontario Hydro, Toronto, ON (Canada)
Guidelines for the prevention of economizer inlet header cracking in fossil boilers: Final report, 15:2412 (R;US)

Oregon Graduate Center, Beaverton, OR (USA). Inst. of Atmospheric Sciences
Sources of methane in China: A program to estimate the emissions from rice paddies, biogas pits and urban areas: Annual progress report, 15:3411 (R;US)

Oregon State Univ., Corvallis, OR (USA). Coll. of Oceanography
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Brown rockfish, copper rockfish, and black rockfish, 15:3537 (R;US)

Oregon State Univ., Corvallis, OR (USA). Dept. of Electrical and Computer Engineering
Adjustable speed drive study, June 1985–September 1988: Part 2, Appendices, 15:3224 (R;US)

Oregon State Univ., Corvallis, OR (USA). Transportation Research Inst.
Applicability of the DMSO (dimethyl sulfoxide) aggregate degradation test to determine moisture-induced distress in asphalt-concrete mixes. Final report, June 1986-June 1987, 15:2980 (R;US)

Oregon State Univ., Newport, OR (USA). Hatfield Marine Science Center
Parallel processing and learning in simple systems. Final report, 10 January 1986-14 January 1989, 15:3595 (R;US)

Oregon Univ., Eugene, OR (USA)
Theory of elementary particles studies in weak interaction and grand unification and studies in accelerator design: Annual report, Task B, 15:3319 (R;US)
Towards a unification of the geometrical, stochastic and dynamical properties of hadronic matter in collision, 15:3980 (R;US)
[Theory of elementary particle studies in weak interaction and grand unification and studies in accelerator design]: Annual progress report, 15:3330 (R;US)
[Theory of elementary particles studies in weak interaction and grand unification and studies in accelerator design]: Annual report, Task A, 15:3945 (R;US)

Oregon Univ., Eugene, OR (USA). Dept. of Physics
Intermittency in multiparticle dynamics, 15:3981 (R;US)

Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science
Average transverse momentum in the geometrical branching model with jets, 15:3979 (R;US)
Left-right symmetric electroweak models, 15:4017 (R;US)
QCD corrections to weak decays, 15:3982 (R;US)
Silicon calorimetry for the SSC[Superconducting Supercollider], 15:3331 (R;US)
When is a heavy quark not a parton? Charged Higgs production and heavy quark mass effects in the QCD-based parton model, 15:3983 (R;US)

Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics
Proceedings of the workshop on neutron scattering and neutron reactions, 15:4164 (R;JP)
Workshop for cascade project, physics using large acceptance spectrograph and its technical considerations, 15:4069 (R;JP;In Japanese)

Oulu Univ. (Finland). Research Inst. of Northern Finland
Peat - Environment - Society. Part 2: Emissions from combustion of peat, 15:2073 (R;FI;In Finnish)

P

Pacific Gas and Electric Co., San Ramon, CA (USA). Technical and Ecological Services
Model validation: Cooling-tower performance: Final report, 15:2415 (R;US)

Pacific Northwest Lab., Richland, WA (USA)
1988 changes to United States law regarding nuclear third party liability, 15:2615 (R;US)
A sensitivity study of near-field thermomechanical conditions in tuff, 15:2227 (R;US)
Acoustic emission during integranular stress corrosion cracking, 15:2849 (R;US)
Air quality monitoring at toxic waste sites: A Hanford perspective, 15:3464 (R;US)
Applicable or relevant and appropriate requirements (ARARs) for radioactive mixed waste, 15:2228 (R;US)
Back to basics, 15:2753 (R;US)
Beyond the IDMY [International Daylighting Measurements Year]: A network instrument for low-cost data acquisition, 15:2699 (R;US)
Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:3371 (R;US)
Current and suspended sediment measurements on the central California continental shelf, 15:3819 (R;US)
Design and operation of gamma scan and fission gas sampling systems for characterization of irradiated commercial nuclear fuel, 15:2440 (R;US)
Detailed analysis of the wake and free-flow characteristics at the Goodnoe Hills MOD-2 site, 15:2381 (R;US)
Environmental monitoring for radionuclides, chemicals, fish and wildlife at a US energy research facility: A case story, 15:3751 (R;US)
Evaluate and characterize mechanisms controlling transport, fate, and effects of army smokes in the aerosol wind tunnel: Transport, transformations, fate, and terrestrial ecological effects of hexachloroethane obscurant smokes: Final report, 15:3463 (R;US)
Evaluation of the ground-water contaminant plume extending from the 183-H Solar Evaporation Basins, 15:2225 (R;US)
Hanford environmental dose reconstruction project: Technical approach, 15:3750 (R;US)
Integrated computer-based tools to facilitate environmental monitoring, assessment, and restoration, 15:2598 (R;US)
International aspects of restrictions of ozone-depleting substances, 15:3462 (R;US)
Meteorological monitoring for environmental/dose assessment and emergency response modeling: How much is enough?, 15:3488 (R;US)
Population dose commitments due to radioactive releases from nuclear power plant sites in 1986, 15:2539 (R;US)
Quality oversight in research and development, 15:4495 (R;US)
Recommendations for evaluating environmental monitoring programs for alternative low-level waste facilities, 15:2231 (R;US)
Regulatory requirements for groundwater monitoring networks at hazardous waste sites, 15:3501 (R;US)
Remediation of DOE hazardous waste sites: Planning and integration requirements, 15:2243 (R;US)
Slurry-fed ceramic melter–A broadly accepted system to vitrify high-level waste, 15:2226 (R;US)
Solid oxide fuel cells electrodes based on IN_2O_3-$PRrO_{1.83}$-ZrO_2, 15:2659 (R;US)
Strontium-90 in Canada goose eggshells: Non-fatal monitoring for contamination in wildlife, 15:3515 (R;US)
Summary of commercial conservation programs environmental issues and program consistency, 15:3517 (R;US)
Summary of residential environmental issues and program consistency, 15:2698 (R;US)
Survey of Columbia River Basin streams for giant Columbia River spire snail Fluminicola columbiana and great Columbia River limpet Fisherola nuttalli, 15:3541 (R;US)
The determination of the penetrating radiation dose at Hanford, 15:4195 (R;US)
The Hanford Environmental Dose Reconstruction Project: Overview, 15:3749 (R;US)
The identification of terrain-induced circulations using principal components, 15:2230 (R;US)
The microdosimetry of radon decay products in the respiratory tract, 15:3748 (R;US)
Trends in radionuclide concentrations for wildlife and food products near Hanford for the period 1971 through 1988, 15:2232 (R;US)

Use of the Multimedia Environmental Pollutant Assessment System (MEPAS) for large- and small-scale applications, 15:2229 (R;US)

Pacific Power and Light Co., Portland, OR (USA)
The Hood River Story: How a conservation project was implemented: Volume 1, Final report, 15:2670 (R;US)

Parameter, Inc., Elm Grove, WI (USA)
Closeout of IE Bulletin 86-01: Minimum flow logic problems that could disable residual heat removal pumps: Minimum flow logic problems that could disable residual heat removal pumps, 15:2544 (R;US)
Closeout of IE Bulletin 86-02: Static "O" ring differential pressure switches, 15:2545 (R;US)

Parana Univ., Curitiba, PR (Brazil). Dept. de Fisica
Determination of X-ray anomalous scattering in silicon, 15:4180 (R;BR;In Portuguese)

Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire
High density matter state equation and phase transitions, 15:4003 (R;FR;In French)

Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)
Review of LOFT [Loss-of-Fluid Test] large break experiments: OECD LOFT project, 15:2551 (R;US)

Pechan (E.H.) and Associates, Inc., Springfield, VA (USA)
1988 interorganizational workshop on future utility SO_2 emissions, 15:2078 (R;US)

PEI Associates, Inc., Cincinnati, OH (USA)
BACT/LAER (Best Available Control Technology/Lowest Achievable Emission Rate) Clearinghouse: A compilation of control-technology determinations. Fourth supplement to 1985 edition. Summary tables and appendices A-H, 15:3491 (R;US)
Evaluation of airborne-asbestos concentrations before and during an O and M (operations and maintenance) activity: A case study, 15:3451 (R;US)

Pennsylvania State Univ., University Park, PA (USA)
Participation in the MAP3S precipitation chemistry network: Progress report, August 1, 1988–July 31, 1989, 15:3410 (R;US)
Transition metal catalyzed transformations of unsaturated molecules, 15:3074 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Applied Research Lab.
Physics and materials science of high-temperature superconductors. Final report, 15:3121 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences
Inhibition of retrogressive reactions in coal/petroleum coprocessing: Quarterly technical progress report, June 1, 1989–August 31, 1989, 15:2025 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Dept. of Astronomy
Relativistic distorted wave collision strengths and oscillator strengths for the 85 Li-like ions with $8 \leq Z \leq 92$, 15:3897 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Dept. of Geosciences
Near-surface neotectonic deformation associated with seismicity in the northeastern United States, 15:3814 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Dept. of Physics
Acoustic studies of new materials: Quasi crystals, low-loss glasses, and high tc superconductors. Annual summary report, 1 October 1988-30 September 1989, 15:2901 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Energy and Fuels Research Center
Enhanced coal liquefaction by low-severity catalytic reactions: Final report, 15:2026 (R;US)

Pennsylvania Univ., Philadelphia, PA (USA)
Synthesis and properties of new preceramic materials: Research progress report, December 1, 1988–November 30, 1989, 15:2970 (R;US)

Pennsylvania Univ., Philadelphia, PA (USA). Dept. of Physics
Status of BNL E791: Study of very rare K_L^0 decays, 15:3984 (R;US)

Pinnacle Research Inst., Cupertino, CA (USA)
The secondary slurry-zinc/air battery: Final report, 15:2579 (R;US)

Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering
Coal surface control for advanced physical fine coal cleaning technologies: Quarterly report, May 1–July 31, 1989, 15:2015 (R;US)

Pittsburgh Univ., PA (USA). Dept. of Chemistry
Characterization of oxidized coal surfaces: Final report, 15:2061 (R;US)

Pittsburgh Univ., PA (USA). Pymatuning Lab. of Ecology
Pathogenic regulation of running water macroinvertebrates: Progress report, January 1, 1989–October 15, 1989, 15:3539 (R;US)

Pittsburgh Univ., PA (USA). Univ. Center for Social and Urban Research
Volunteering for emergency preparedness. Final report, March 1988-March 1989, 15:4550 (R;US)

Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Engenharia Mecanica
Thermohydraulic analysis of smooth and finned annular ducts, 15:3189 (R;BR;In Portuguese)

Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Quimica
Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)
Geochemical of the sodic-uranium metasomatic mineralization from Espinhas (PB)-Brazil, 15:2160 (R;BR;In Portuguese)

Portland State Univ., OR (USA). Center for Transit Research and Management Development
Understanding the dynamics of innovation in urban transit. Final report on Phase 2, 15:2714 (R;US)

Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)
Natural analogue study of volcanic glass. A case study of basaltic glasses in pyroclastic fall deposits of Fuji volcano, Japan, 15:3804 (R;JP)
Plutonium diffusivity in compacted bentonite, 15:2223 (R;JP)
Static leaching of actinides and fission products from fully radioactive waste glass of HLLW generated in Tokai reprocessing plant, 15:2224 (R;JP)

Princeton Univ., NJ (USA). Plasma Physics Lab.
Energy confinement time and electron density profile shape in TFTR [Tokamak Fusion Test Reactor], 15:4350 (R;US)
Study of electron density and pressure profile behavior in a tokamak plasma, 15:4351 (R;US)

PTI Environmental Services, Bellevue, WA (USA)
Comparison of bioassays for assessing sediment toxicity in Puget Sound. (Appendices included). Report for 1988-1989 (Final), 15:3561 (R;US)

Purdue Research Foundation, Lafayette, IN (USA)
[Gamma scattering in condensed matter with high intensity Moessbauer radiation]: Progress report, 15:4212 (R;US)

Q

Quaid-I-Azam Univ., Islamabad (Pakistan)
Resistivity measurements of superconducting materials. Master's thesis, 15:2932 (R;PK)

R

Raastofforvaltningen for Groenland, Copenhagen (Denmark)
Report for the period 1 July 1988–30 June 1989 from the Mineral Resources Administration in Greenland, 15:2600 (R;DK;In Danish)

Radian Corp., Austin, TX (USA)
Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report, 15:2143 (R;US)

Radian Corp., Research Triangle Park, NC (USA)
Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:2772 (R;US)

Best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:2773 (R;US)

Radian Corp., Sacramento, CA (USA)
Installation-Restoration Program Stage 3. McClellan AFB, California. Remedial investigation/feasibility study ground-water sampling and analysis program, January through March 1989 data summary. Final report, January-March 1989, 15:3542 (R;US)

Railway Technical Research Inst., Kokubunji, Tokyo (Japan)
Fuel-injected system for diesel engines with injection pressure control, 15:2787 (R;JP)

Rensselaer Polytechnic Inst., Troy, NY (USA)
Evolution of reaction center in an explosive material, 15:3106 (R;US)

Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering
Exploratory study of niobium, titanium, zirconium, and tantalum aluminides. Final report, 1 March 1988-31 May 1989, 15:2807 (R;US)
Rhenium alloying of tungsten heavy alloys, 15:2808 (R;US)

Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Mechanical Engineering, Aeronautical Engineering and Mechanics
Continuous high-temperature lubrication of ceramics by carbon generated catalytically, 15:2900 (R;US)

Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Nuclear Engineering and Engineering Physics
The TITAN Reversed-Field Pinch fusion reactor study: Collection of papers, 15:4443 (R;US)

Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)
Light sensitivity of .13 mm thick LiF-teflon thermoluminesence dosimeters, 15:4185 (R;US)

Rikkyo Univ., Yokosuka, Kanagawa (Japan). Inst. for Atomic Energy
Proceedings of Institute for Atomic Energy, Rikkyo University (IAERU) seminar-4, 15:4486 (R;JP)

Risk and Industrial Safety Consultants, Inc., Des Plaines, IL (USA)
Dike insulation for LNG (liquefied natural gas) vapor mitigation. Topical report, September 1987-December 1988, 15:2154 (R;US)

Risoe National Lab., Roskilde (Denmark)
Calculation of air pollution dispersion over a complex terrain with special emphasis on dimensioning of chimney stacks, 15:3420 (R;DK;In Danish)
CROSS SECTION. Program description and user manual, 15:3137 (R;DK)
Development of a data-processing model for steady turbulent 3-D gas particle flow, 15:3110 (R;DK;In Danish, English)
Flywheel for vehicles, 15:2562 (R;DK;In Danish)
Generation of fatigue loads on Windane 40/2, 15:2382 (R;DK;In Danish)
HERMES-model for Denmark, 15:4525 (R;DK)
Meteorology and Wind Energy Department annual progress report 1 January - 31 December 1988, 15:2361 (R;DK)
Simulation of the Italian energy system with the DESS-model, 15:2626 (R;DK)

Rochester Univ., NY (USA). Dept. of Chemical Engineering
Pore structure and reactivity changes in hot coal gas desulfurization sorbents: Technical progress report, July–September 1989, 15:2067 (R;US)

Rochester Univ., NY (USA). Inst. of Optics
Modulation mixing in a multimode dye laser, 15:3153 (R;US)

Rockwell International Corp., Canoga Park, CA (USA). Energy Technology Engineering Center
The Gevaltig: An inertial fusion powered manned spacecraft design for outer solar system missions, 15:2710 (R;US)

Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant
Abstract for Zeiss editor presentation, 15:4524 (R;US)
Development of a hazardous materials dispersion modeling capability with application to ambient air monitoring network design: Project plan, 15:3465 (R;US)
Hydrogen permeability coefficient determinations for used waste drum liners, 15:2985 (R;US)

Rockwell International Corp., Thousand Oaks, CA (USA). Science Center
Growth of tungsten bronze family crystals. Final technical report, 6 May 1985-30 November 1988, 15:2809 (R;US)

Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)
Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report, 15:2195 (R;US)

Ruhrkohle A.G., Essen (Germany, F.R.)
Shaping of working conditions for handicapped persons according to results of human-engineering research in hardcoal mining - main phase. Final report, 15:2103 (R;DE;In German)

Rutgers–the State Univ., New Brunswick, NJ (USA)
Selection with minimal bias, of an experimental control from natural wetland environments. Technical report (Final), 15:3576 (R;US)

Rutgers–the State Univ., New Brunswick, NJ (USA). Center for Coastal and Environmental Studies
Influence of discharge and urbanization on the concentration, speciation, and bioavailability of trace metals in the Raritan River, New Jersey. Final report, 15:3551 (R;US)

Rutgers–the State Univ., Piscataway, NJ (USA). Dept. of Chemical and Biochemical Engineering
Conventional research house: Cooling characterization test results. Topical report, June-September 1987, 15:2697 (R;US)

Rutherford Appleton Lab., Chilton (UK)
90-GeV Higgs boson in supersymmetric models, 15:4024 (R;GB)
Half-string oscillator approach to string field theory, 15:4045 (R;GB)
Light kaonic and antiprotonic atoms, 15:3893 (R;GB)
Particle physics experiments 1988, 15:3961 (R;GB)
Towards a 'pointless' generalisation of Yang-Mills theory, 15:4046 (R;GB)

S

San Francisco State Univ., CA (USA)
Binding of adenosine diphosphoribosyltransferase to the termini and internal regions of linear DNAs (deoxyribonucleic acids), 15:3597 (R;US)

Sandia National Labs., Albuquerque, NM (USA)
3D thermal stress analysis of WIPP [Waste Isolation Pilot Plant] Room T RH TRU [Remote Handled Transuranic] experiments, 15:2235 (R;US)
A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation, 15:2541 (R;US)
An experimental investigation of wall-interference effects for parachutes in closed wind tunnels, 15:3139 (R;US)
ANEOS [analytic equation of state package] models for shock compression of saturated limestone: Applications to ground shock calculations, 15:3081 (R;US)
Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 15:2233 (R;US)
Autonomous land navigation in a structured environment, 15:3138 (R;US)
Cure analysis of printed-circuit boards containing reactive adhesive layers, 15:3226 (R;US)
Detection of a chirping electromagnetic signal, 15:4288 (R;US)
Energy technologies at Sandia National Laboratories: Past, Present, Future, 15:2612 (R;US)
Fast transit gas- and condensed-phase chemistry of energetic materials, 15:3381 (R;US)
High-efficiency silicon concentrator solar cells for use with prismatic covers, 15:2302 (R;US)
In-situ ion beam measurements of deuterium loading in thin foil electrochemical cells, 15:2853 (R;US)
Loss minimization through recombination center identification, 15:2301 (R;US)
Loss-of-coolant accident (LOCA) testing of aged cables for nuclear plant life extension, 15:2476 (R;US)
Magma energy extraction: Annual report for FY88, 15:2360 (R;US)

Microwave coupling phenomenology of pc [printed-circuit] boards, 15:3227 (R;US)
Performance characteristics of a three-stage railgun, 15:3220 (R;US)
Physics guide to CEPXS: A multigroup coupled electron-photon cross-section generating code: Version 1.0, 15:3894 (R;US)
Position of Sandia National Laboratories with respect to product definition standards, 15:4527 (R;US)
Predicting flow through low-permeability, partially saturated, fractured rock: A review of modeling and experimental efforts at Yucca Mountain, 15:2234 (R;US)
RADLAC-II propagation experiments, 15:3895 (R;US)
Reverse Hopkinson bar testing, 15:3389 (R;US)
RLA simulations, 15:3274 (R;US)
Seismic signal modeling of the RSTN and the NORESS/ARCESS data, 15:3815 (R;US)
Shock-wave characterization of energetic booster-rocket propellant WAK-2 and its simulant UGS, 15:2260 (R;US)
Single fluid simulations of plasma openings switch behavior, 15:3308 (R;US)
Summary of RLA [Recirculating Linear Accelerator] beam transport experiments using a 1.5 MV injector, 15:3275 (R;US)
Surface and bulk properties which influence ion-beam hydrogenation of silicon, 15:2852 (R;US)
The Waste Isolation Pilot Plant (WIPP) Seal System Performance Program, 15:2236 (R;US)

Sands (Anne), Mill Valley, CA (USA)
The ecology of riparian habitats of the southern California coastal region: A community profile, 15:3538 (R;US)

Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica
Characterization of the emerald of Santa Terezinha de Goias by spectroscopy, fluorescence and X-ray difraction, 15:4226 (R;BR;In Portuguese)

Sao Paulo Univ., SP (Brazil). Faculdade de Medicina
Rapid purification of radiodinated glucagon with Sep-Pak^{R} reversed phase cartridges, 15:3621 (R;BR)

Sao Paulo Univ., SP (Brazil). Inst. de Fisica
Dating of aragonite and dolomite from Devil's cave - SP, by dosimetric thermoluminescent method (DTL) and ESR, 15:3057 (R;BR;In Portuguese)
Decay of ^{57}Ni, 15:4084 (R;BR;In Portuguese)
Fluorescence and optical absorption in spodumene, 15:2971 (R;BR;In Portuguese)
Thermoluminescent of induced calcite by gamma and ultraviolet radiation, 15:4225 (R;BR;In Portuguese)

Sao Paulo Univ., SP (Brazil). Inst. de Quimica
Addition compounds between trifluoromethanessulfonates and N,N-Dimethylacetamide (DMA), 15:3045 (R;BR;In Portuguese)
Analytical use of zide ion. Chemical equilibrium studies and correlates in U(VI)/N_3 and Co(III)/N_3 systems, 15:3047 (R;BR;In Portuguese)
Cholesteric lyomesophases based on sodium N-lauroyl asparte: characterization of new system by nuclear magnetic resonance and polarizing microscopy, 15:3076 (R;BR;In Portuguese)
Spectrophotometric investigation of addition compounds between neodymium (III) and europium (III) perchorates and hexafluorophosphate and cyclic ligants with two oxygen in opposite position, 15:3055 (R;BR;In Portuguese)
Study of niobium corrosion in alkaline medium, 15:2837 (R;BR;In Portuguese)

Science and Engineering Associates, Inc., Albuquerque, NM (USA)
Radiation-related impacts for nuclear plant physical modifications: Final report, 15:2543 (R;US)

Science Applications International Corp., Bellevue, WA (USA)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Wood-treating industries, 15:2737 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Printing and publishing, 15:2738 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Dry cleaners and commercial laundries, 15:2739 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Analytical laboratories, 15:2740 (R;US)

Science Applications International Corp., McLean, VA (USA)
Development of the advanced utility simulation model. Report for May 1985-September 1988, 15:2430 (R;US)
System software for Soviet computers, 15:4526 (R;US)
United States policy on negative security assurances: A reassessment, 15:2803 (R;US)

Science Applications International Corp., San Diego, CA (USA)
Operation and performance of commercial cool storage systems: Volume 1, 1987 cooling season, 15:2564 (R;US)
Operation and performance of commercial cool storage systems: Volume 2, 1988 cooling season and project summary, 15:2565 (R;US)

SCS Engineers, Inc., Long Beach, CA (USA)
Waste audit study: Automotive paint shops, 15:2744 (R;US)

Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)
Simulation of energy consumption by taking thermal comfort into account, 15:2701 (R;NO)

Siemens A.G. Unternehmensbereich KWU, Erlangen (Germany, F.R.)
Experimental analysis of the behavior of iodine in the event of hypothetical accidents - iodine partition coefficients (follow-on project). Final report, 15:2555 (R;DE;In German)

Siemens A.G., Erlangen (Germany, F.R.). Unternehmensbereich Medizinische Technik
Design and test of a MR-imager with superconducting magnet. Final report, 15:3624 (R;DE;In German)

Skibsteknisk Laboratorium, Lyngby (Denmark)
Power mesurements on a 99 kW "Smedemoelle" wind turbine, erected at Hasle, Bornholm, 15:2385 (R;DK;In Danish)

Skovteknisk Inst., Copenhagen (Denmark)
Flue gas condensation in stoking system for wood chips, 15:2272 (R;DK;In Danish)

Smithsonian Institution, Cambridge, MA (USA). Smithsonian Astrophysical Observatory
Coronagraph observations and analyses of the ultraviolet solar corona. Semiannual status report, 1 April 1987-31 March 1989, 15:3868 (R;US)

Sociedade Brasileira de Geologia, Sao Paulo, SP (Brazil)
Geology and Geochronology of Abuna-Ariquemes-RO, 15:3044 (R;BR;In Spanish)

Solar Energy Research Inst., Golden, CO (USA)
An initial look at the dynamics of the microscale flow field within a large wind farm in response to variations in the natural inflow, 15:2384 (R;US)
Computer simulation of wind/diesel system operation, 15:2383 (R;US)
Desiccant cooling and dehumidification opportunities for buildings workshop, 15:2700 (R;US)
High-efficiency large-area CdTe modules: Annual subcontract report, 1 July 1988–30 June 1989, 15:2306 (R;US)
Membrane separation processes for liquid hydrocarbons and gases in the petrochemical industry: A technical case study, 15:2118 (R;US)
Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 3 final subcontract report, February 1, 1986–January 31, 1987, 15:2303 (R;US)
Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 1, Annual subcontract report, February 1, 1987–January 31, 1988, 15:2304 (R;US)
Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 2, Semiannual report, February 1, 1988–July 31, 1989, 15:2305 (R;US)
Thin film cadmium telluride, zinc telluride, and mercury zinc telluride solar cells: Annual subcontract report, 1 July 1988–30 June 1989, 15:2307 (R;US)
US polycrystalline thin film solar cells program, 15:2308 (R;US)

Solarex Corp., Newtown, PA (USA). Thin Film Div.
Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 3 final subcontract report, February 1, 1986–January 31, 1987, 15:2303 (R;US)

Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility
Outlook and perspectives (excited baryons, 1988), 15:3948 (R;US)

Southern Illinois Univ., Carbondale, IL (USA). Coal Extraction and Utilization Research Center
High-sulfur coal research at the SIUC [Southern Illinois University at Carbondale] Coal Technology Laboratory: Quarterly progress report, July 1–September 30, 1989, 15:2058 (R;US)

Southern Methodist Univ., Dallas, TX (USA). Dept. of Computer Science and Engineering
Optimization algorithms for new computer architectures with applications to personnel-assignment models. Annual report (Final), 1 May 1988-30 April 1989, 15:4501 (R;US)

Southern Research Inst., Birmingham, AL (USA)
Characterization and modification of particulate properties to enhance filtration performance: Quarterly technical progress report, December 1988–February 1989, 15:2423 (R;US)
Measurement of condensable vapor contribution to PM10 emissions, 15:2696 (R;US)

Southwest Research Inst., San Antonio, TX (USA)
Coal-fueled diesel systems research: Volume 1, Basic fuel, fuel system, and combustion studies: Final report, 15:2796 (R;US)
Gas turbine blade life assessment and repair guide: Final report, 15:2414 (R;US)
Measurement of on-road vehicle emission factors in the California South Coast Air Basin. Volume 1. Regulated emissions. Final report, 15:2796 (R;US)
Sliding seal materials for low heat rejection engines, 15:2783 (R;US)

Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility
US Marine 3rd Tank Battalion lubrication evaluation under hot ambient temperatures at Twenty-Nine Palms, California. Interim report, April-September 1988, 15:2122 (R;US)

Space Power, Inc., San Jose, CA (USA)
Megawatt class nuclear space power systems (MCNSPS) conceptual design and evaluation report. Volume 2, technologies 1: Reactors, heat transport, integration issues. Final report, 15:2464 (R;US)

SRI International, Menlo Park, CA (USA)
Influence of microstructure and microdamage processes on fracture at high loading rates. Final report, 1 February 1986-30 September 1988, 15:2806 (R;US)
Laser probes of natural gas ignition chemistry. Annual report, January-December 1988, 15:2153 (R;US)
Processing and fabrication of high-temperature oxide superconductors. Annual report, 1 August 1988-30 June 1989, 15:2897 (R;US)
Rewrite Rule Machine project. Final report, 15:4500 (R;US)

SRI International, Menlo Park, CA (USA). Molecular Biology Dept.
Cloning and characterization of the recA gene of Aquaspirillum magnetotacticum, 15:3610 (R;US)
Genetic engineering of single-domain magnetic particles. Progress report, 1 March-15 June 1989, 15:3611 (R;US)

Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)
Conduct of local dosimetry in X-ray diagnosis, 15:4197 (R;DD;In German)
Experience in the use of the UA-type teaching kit of sealed radioactive sources, 15:4199 (R;DD;In German)
Radiation protection measurements at a UA-type teaching kit of sealed radioactive sources, 15:4198 (R;DD;In German)
State control in the GDR of the handling of unsealed radioactive materials in laboratories of type I to III, 15:4196 (R;DD;In German)

Stadtwerke Muenster G.m.b.H. (Germany, F.R.)
The DESONOX flue gas purification process, 15:2427 (R;DE;In German)

Stanford Linear Accelerator Center, Menlo Park, CA (USA)
A search for single electron production in electron positron annihilation at E = 29 GeV, 15:3964 (R;US)
An adiabatic focuser, 15:3277 (R;US)
B physics at the Z^0 pole, 15:3966 (R;US)
Coherent pair creation from beam-beam interaction, 15:3278 (R;US)
Final focus test beam alignment: A draft proposal, 15:3310 (R;US)
Finding the magnetic center of a quadrupole to high resolution: A draft proposal, 15:3309 (R;US)
Optimizing the average longitudinal phase of the beam in the SLC linac, 15:3276 (R;US)
Proceedings of the tau-charm factory workshop: Study of tau, charm and J/psi physics; development of high luminosity esup +esup minus rings; design of esup +esup minus detectors for tau-charm physics, 15:3962 (R;US)
Rare decays, 15:3965 (R;US)
Recent results on weak decays of charmed mesons from the Mark III experiment, 15:3967 (R;US)
Study of four-lepton final states in electron-positron interactions at 29 GeV, 15:3963 (R;US)
The digital data acquisition chain and the cosmic ray trigger system for the SLD Warm Iron Calorimeter, 15:3357 (R;US)

Stanford Univ., CA (USA)
Statistical study of the correlation of hard X-ray and type 3 radio bursts in solar flares, 15:3850 (R;US)
Studying turbulence using numerical simulation databases, 2. Proceedings of the 1988 Summer Program, 15:3203 (R;US)

Stanford Univ., CA (USA). Dept. of Civil Engineering
In-situ aquifer restoration of chlorinated aliphatics by methanotrophic bacteria. Research report, 1 May 1985-30 April 1989, 15:3554 (R;US)

Stanford Univ., CA (USA). Dept. of Operations Research
A basic theorem of complementarity for the generalized variational-like inequality problem: Technical report, 15:4529 (R;US)
Computational and statistical issues in discrete-event simulation. Technical report, 15:4502 (R;US)

Stanford Univ., CA (USA). Edward L. Ginzton Lab.
Laser physics and laser techniques. Final report, 15:3154 (R;US)
Lasers without inversion: Interference of lifetime-broadened resonances, 15:3152 (R;US)
Non-reciprocity of autoionizing interferences: Lasers without inversion, 15:3151 (R;US)

Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.
An engineering model for coal devolatilization: Quarterly report, March 15, 1989–June 15, 1989, 15:2098 (R;US)

Stanford Univ., CA (USA). Systems Optimization Lab.
A class of "onto" multifunctions, 15:4548 (R;US)
A modified Newton method for unconstrained minimization, 15:4547 (R;US)
Generalized quasi-variational inequality and implicit complementarity problems, 15:4528 (R;US)
On the identification of local minimizers in inertia-controlling methods for quadratic programming, 15:4546 (R;US)
Sequential quadratic programming algorithms for optimization, 15:4545 (R;US)

State Univ. of New York, Stony Brook, NY (USA). Dept. of Chemistry
Stable isotope studies: Progress report, October 1988–October 1989, 15:3075 (R;US)

Statens Energiverk, Stockholm (Sweden)
Ammonia addition for NO_x reduction in fluidized bed boilers, 15:2074 (R;SE)
Effect of reductive decomposition of $CaSO_4$ on sulphur capture in fluidised bed boilers, 15:3250 (R;SE)
Emission of nitrogen oxide from a circulating fluidized bed boiler - the influence of design parameters, 15:3466 (R;SE)
Energy in Sweden 1988, 15:2625 (R;SE)
Evaluation of the relation (coherence) between wind speed and various set parameters at the Naesudden wind power plant, 15:2386 (R;SE;In Swedish)
Heat transfer in circulating fluidized bed boilers, 15:2101 (R;SE)
Petroleum fuels. Development of quality from 1980 and on, 15:2135 (R;SE;In Swedish)

Statistisches Landesamt Baden-Wuerttemberg, Stuttgart (Germany, F.R.)
Energy report 1987/88, 15:2590 (R;DE;In German)

Stichting Energieonderzoek Centrum Nederland, Petten (Netherlands). Energie Studie Centrum
Cogeneration- and Total Energy potentials at an alternative natural gas price policy and environmental policy in the Dutch National Energy Outlook scenarios, 15:2619 (B;NL;In (In Dutch))

Greenhouse gas emission coefficients from the energy system. Two methods to calculate national CO_2-e issions, 15:2599 (B;NL)
National report for the Netherlands. The IEA energy technology systems analysis project (ETSAP)/Annex 3, 15:3470 (B;NL)

Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)
Energy management, 15:2754 (R;SE;In Swedish)
Experiences of DOAS technique for flue gas measurements, 15:3467 (R;SE;In Swedish)
Quality control and requirements for corona heated HDPE casing for district heating pipelines, 15:2779 (R;SE;In Swedish)
Sensitivity to hydrogen embrittlement in connection with cathodic protection of stainless duplex steels, 15:2854 (R;SE;In Swedish)

Stone (Ralph) and Co., Inc., Los Angeles, CA (USA)
Waste audit study: Research and educational institutions, 15:2746 (R;US)

Strasbourg-1 Univ., 67 (France)
Study of the structure of the transition nuclei ^{152}Dy, ^{154}Dy and ^{156}Er at high angular momentum, 15:4088 (R;FR;In French)

Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires
CRN: 1987 Progress Report, 15:4485 (R;FR;In French)
Study of the structure of the transition nuclei ^{152}Dy, ^{154}Dy and ^{156}Er at high angular momentum, 15:4088 (R;FR;In French)

Stuttgart Univ. (Germany, F.R.). Fakultaet 4 - Elektrotechnik
Radiation-physical properties of selective solar absorbers, 15:2346 (R;DE;In German)

Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme
Computer-aided analysis of heating pipe networks, 15:2681 (R;DE;In German)

Sverdrup Technology, Inc., Cleveland, OH (USA)
Antiproton powered propulsion with magnetically confined plasma engines, 15:2780 (R;US)

Swedish Council for Building Research, Stockholm (Sweden)
Effects on zooplankton when passing through an open lake water heat pump, 15:3800 (R;SE;In Swedish)

Swedish Environmental Research Inst., Stockholm (Sweden)
Monitoring of air pollution in the southern counties, 15:3478 (R;SE;In Swedish)

Swedish National Board for Technical Development, Stockholm (Sweden)
Evaluation of the contributions made by STU (National Swedish Board for Technical Development) to the sphere of energy. Summary and conclusions, 15:2613 (R;SE;In Swedish)
Separation of wood chips for energy production, 15:2275 (R;SE;In Swedish)

Swedish Nuclear Power Inspectorate, Nykoeping (Sweden)
Assessment of RELAP5/MOD2, Cycle 36.04 against FIX-II split break experiment No. 3051, 15:2552 (R;US)

Swedish State Power Board, Vaellingby (Sweden)
Industrial load management at Vaargaarda, 15:2641 (R;SE;In Swedish)

Swedish Univ. of Agricultural Sciences, Garpenberg (Sweden). Dept. of Operational Efficiency
Handling characteristics of wood fuels - angle of repose for different assortments, 15:2274 (R;SE;In Swedish)

Syracuse Research Corp., NY (USA)
Toxicological profile for selected PCBs (polychlorinated biphenyls) (Aroclor-1260, -1254, -1248, -1242, -1232, -1221, and -1016). Final report, 15:3785 (R;US)

Syracuse Univ., NY (USA)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 7. Part A. Time oriented problem solving. Interim report, December 1986-December 1987, 15:4499 (R;US)

Systems Applications, Inc., San Rafael, CA (USA)
Sensitivity of a regional oxidant model to variations in climate parameters. Volume 1 and 2. Final report, 15:3453 (R;US)

T

TDA Research, Inc., Wheat Ridge, CO (USA)
Photoconversion of inorganics to methane. Final topical report, October 1987-February 1989, 15:2267 (R;US)

Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen
Production of coke with specific metallurgical properties. Analysis of conditions in the blast furnace, 15:2029 (R;DE;In German)

Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Chemische Technologie
Key chemicals from synthesis gas - development of novel zeolites as catalysts for conversion of methanol into hydrocarbons, 15:2028 (R;DE;In German)

Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Wasserversorgung, Abwasserbeseitigung und Raumplanung
Rationalization of aerobic-thermophilic stabilisation by means of raw sludge dehydration, 15:2760 (R;DE;In German)

Technische Univ. Berlin (Germany, F.R.)
Festive colloquium to celebrate the 70th anniversary of Prof. em. o. Dr.-Ing. Friedrich Adler. Berlin, October 17, 1986, 15:2085 (R;DE;In German)

Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen
Basic investigation of mixtures consisting of binders and tailings from coal mining with regard to their applicability as building materials in the mining industry, 15:2072 (R;DE;In German)

Technische Univ. Muenchen (Germany, F.R.). Lehrstuhl fuer Thermische Kraftanlagen mit Heizkraftwerk
Flue gas denitrification processes using tissue filters. Final report, 15:2426 (R;DE;In German)

Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (Germany, F.R.). Inst. fuer Unfallforschung und Ergonomie (IfU)
Development of methods for the evaluation and reduction of risk factors for the maintenance of nuclear power plants, 15:2435 (R;DE;In German)

Technischer Ueberwachungs-Verien Rheinland e.V., Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz
Determination of compatibility conditions of the burner/boiler system of heating equipment with a view to energy conservation by means of optimum adjustment of components. Final report. Pt. 3. Investigations of pressure swings in the starting process in a burner/boiler system, 15:3235 (R;DE;In German)

Technology Transition Corp., Washington, DC (USA)
Hydrogen conference: Workshop proceedings, 15:2258 (R;US)

Teknologisk Inst., Taastrup (Denmark). Bioteknik
Two-step process for conversion of lignocellulose into methane, 15:2266 (R;DK)

Tel Aviv Univ. (Israel)
Treatment of laser-induced retinal injuries. Final report, 12 February 1985-31 January 1987, 15:3797 (R;IL)

Temple Univ., Philadelphia, PA (USA)
Gastric response to methyl methacrylate vapor. Progress report, 15:3769 (R;US)

Temple Univ., Philadelphia, PA (USA). Dept. of Physics
Experimental investigations in particle physics at intermediate energies: Performance report, December 1, 1988–December 31, 1989, 15:3951 (R;US)
$K_L^0 \rightarrow \mu^{\mp} e^{\pm}$ at the Fermilab main injector, 15:3950 (R;US)
Muon capture at large y-energetic nucleon emission, 15:4083 (R;US)
The low energy frontier in high energy particle physics, 15:3332 (R;US)

Tennessee Univ., Knoxville, TN (USA). Dept. of Chemistry
New chemical alternatives to chlorofluorocarbons and halons. Report for August 1988-February 1989, 15:3436 (R;US)

Tennessee Univ., Knoxville, TN (USA). Dept. of Physics
[Elementary particle interactions]: Progress report, 15:3978 (R;US)

Texas A and M Univ., College Station, TX (USA). Center for Tectonophysics
Anisotropic yielding of rocks at high temperatures and pressures: Technical progress report No. 1, April 15, 1987–April 14, 1988, 15:2358 (R;US)

Texas A and M Univ., College Station, TX (USA). Texas Transportation Inst.
Revised manual for planning, designing, and operating transitway facilities in Texas. Research report, September 1983-August 1988 (Final), 15:2711 (R;US)

Texas Univ., Austin, TX (USA)
Feasibility study of methods for stopping the depletion of ozone over Antarctica. Final report, 15:3417 (R;US)
The free energy of Maxwell-Vlasov equilibria, 15:4309 (R;US)

Texas Univ., Austin, TX (USA). Center for Energy Studies
Effect of shading devices on residential energy use in Austin, Texas. Research report, 15:2694 (R;US)

Texas Univ., Austin, TX (USA). Center for Studies in Statistical Mechanics
The behavior of matter under nonequilibrium conditions: Fundamental aspects and applications: Progress report, April 15, 1989–April 14, 1990, 15:4262 (R;US)

Texas Univ., Austin, TX (USA). Inst. for Fusion Studies
Introduction to bifurcation theory, 15:4310 (R;US)
Stability of the Global Alfven Eigenmode in the presence of fusion alpha particles in an ignited tokamak plasma, 15:4308 (R;US)

Tohoku Univ., Sendai (Japan)
Measurements of prompt fission neutron spectra and double-differential neutron inelastic-scattering cross sections for ^{238}U and ^{232}Th, 15:4119 (R;JP;In Japanese)

Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study
Breaking of separability condition for dynamical collective subspace. Onset of quantum chaos in large-amplitude collective motion, 15:4152 (R;JP)
Degenerate fermion and Wilson loop in 1+1 dimensions, 15:4021 (R;JP)
Design of a large superconducting spectrometer magnet, 15:3296 (R;JP)
Dissipation mechanism of the large-amplitude collective motion. Dynamical evolution of a collective bundle of trajectories in the TDHF phase space for a simple soluble model, 15:4155 (R;JP)
Double-periodic wormholes in theories with global symmetries, 15:4020 (R;JP)
Estimation of the one-loop mass shifts in open superstring theory, 15:4022 (R;JP)
Extended local gauge invariance and the BRS symmetry in stochastic quantization of gauge fields, 15:4043 (R;JP)
Nuclear collective rotation in the SU_3 model, 2. Quantal rotation for a triaxial configuration, 15:4153 (R;JP)
Nuclear collective rotation in the SU_3 model, 3. Quantal rotation for an axially symmetric configuration, 15:4154 (R;JP)
Possible measurement of the gravitational acceleration of molecules, atoms, nuclei, elementary particles and antiparticles, 15:3958 (R;JP)
Study of hypernuclei via (π^+, K^+) reactions at KEK, 15:3957 (R;JP)
Super-hypernuclei in the quark-shell model, 2, 15:4002 (R;JP)
Universe as a topological defect in a higher-dimensional Einstein-Yang-Mills theory, 15:3827 (R;JP)

Toyota Motor Co. Ltd., Aichi (Japan)
Development of mechanical-pilot injection device for automotive diesel engines, 15:2786 (R;JP)
Development of thermal-resistant catalysts, 15:2795 (R;JP)

TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.
MHD [Magnetohydrodynamics] Integrated Topping Cycle Project: Fourth quarterly technical progress report, May 1, 1988–July 31, 1988, 15:2649 (R;US)

U

U.S. Fuel Cells, Inc. (USA)
An approach for testing fuel-cell/battery hybrid power sources for bus applications, 15:2658 (R;US)

UKAEA Atomic Energy Establishment, Winfrith (UK). Chemistry Div.
Characterisation of molecular boric acid by mass spectrometry and matrix isolation-infrared spectroscopy, 15:3068 (R;GB)
Immobilisation in cement of ion exchange resins arising from the purification of reagents used for the decontamination of reactor circuits. Fourth semestrial report January-June 1988, 15:2175 (R;GB)
Matrix isolation-infrared and mass spectrometric studies of high-temperature molecules, 15:3039 (R;GB)
New estimates for the thermodynamic functions of molecular boric acid, 15:3069 (R;GB)
Rheological measurements on cement grouts, 15:2177 (R;GB)

UKAEA Atomic Energy Establishment, Winfrith (UK). Materials Technology Div.
Gas velocity measurements in purged port posting systems, 15:3124 (R;GB)
Ultrasonic and immersion cleaning: a comparison using aqueous and fluorocarbon solvents, 15:2176 (R;GB)

UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div.
Calculated performance of a "hot-patch" for steady state post dry-out experiments, 15:3186 (R;GB)
Method for predicting the impact velocity of a projectile fired from a compressed air gun facility, 15:3122 (R;GB)
Three-dimensional effects in flask impact testing, 15:3123 (R;GB)

UKAEA Harwell Lab. (UK). Energy Technology Div.
Adaptive pitch control for power regulation of the MS-2 wind turbine, 15:2363 (R;GB)
Electricity producing renewable energy technologies common costing methodology. V. 2, 15:2647 (R;GB)
Small scale hydroelectric generation potential in the UK. V. 1, 15:2276 (R;GB)
WEG MS-2 stall-regulated rotor study, 15:2362 (R;GB)

UKAEA Harwell Lab. (UK). Materials Development Div.
Evolution of pH in a radwaste repository: internal reactions between concrete constituents, 15:2178 (R;GB)
Management of tritium wastes in the United Kingdom. A survey of present and future arisings, review of possible disposal options and areas where further R and D may be needed to develop a management strategy for the future, 15:2179 (R;GB)

UKAEA Northern Research Labs., Risley (UK)
Detection of fine pore structures in graphite by impregnation with Wood's metal, 15:2978 (R;GB)

Umweltbundesamt, Berlin (Germany, F.R.)
Water quality criteria and management models for the tidal region of the Elbe-River, 15:3566 (R;DE;In German)

UNESP, Araraquara, SP (Brazil). Inst. de Quimica
Electrochemistry of pentaamminruthenium (II) complexes with cyanopyridinium ions, 15:3053 (R;BR;In Portuguese)

Union Electric Co., St. Louis, MO (USA)
Knowledge-based system: Voltage and VAR [volt-ampere-reactive] dispatch: Final report, 15:2411 (R;US)

Unit Tenaga Nuklear, Bangi, Selangor (Malaysia)
Effect of heat treatment of toughness and strength properties of C-Mn steel, 15:2850 (R;MY)
Electron beam (EB) curing of wood surface finishing - lamination of PVC film on wood substrates. Final report STA scientist exchange program JAERI, Takasaki, Japan (September to November 1988), 15:2256 (R;MY)
Non-destructive radiometry inspection technique for locating reinforcements and void/porosity in bridge bearings, 15:2257 (R;MY)
Preparation methodology of radiation - curable resin. Unsaturated polyesters, 15:2255 (R;MY)
Radiation hazard from the tantalum dumps in Penang, 15:2244 (R;MY)
Synthesis of acrylated urethane oligomer, 15:3080 (R;MY)
Synthesis of acrylic prepolymer, 15:2983 (R;MY)
Synthesis of epoxidised soya bean oil acrylate, 15:2984 (R;MY)

Universidade Estadual de Campinas, SP (Brazil). Inst. de Quimica
Study of α-monosubstituted methyl acetates by C-13 and H-1 Nuclear Magnetic resonance, 15:4221 (R;BR;In Portuguese)

Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia
Computer-aided event tree analysis by the impact vector method, 15:2475 (R;BR;In Portuguese)
Computerized tomographic in non-destructive testing, 15:3334 (R;BR;In Portuguese)
Considerations about the uncertainty propagation in the probabilistic safety analysis, 15:2446 (R;BR;In Portuguese)
Environmental protection and safety of nuclear facilities, 15:2529 (R;BR;In Portuguese)
Event tree for the Angra 1 big LOCA, 15:2447 (R;BR;In Portuguese)
Falling-sphere radioactive viscometry, 15:3190 (R;BR;In Portuguese)
Reliability study of low pressure recirculation system of Angra 1, 15:2448 (R;BR;In Portuguese)

Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Biofisica
Simultaneous determination of Rn-220 and Rn-222 concentrations in atmospheres by cellulose nitrate ionographic detectors, 15:3056 (R;BR;In Portuguese)

University of South Florida, Tampa, FL (USA)
Thermal evaluation of advanced solar dynamic heat receiver performance. Final report, January-December 1988, 15:2320 (R;US)
Thin film cadmium telluride, zinc telluride, and mercury zinc telluride solar cells: Annual subcontract report, 1 July 1988–30 June 1989, 15:2307 (R;US)

Unocal Corp., Parachute, CO (USA). Energy Mining Div.
Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan quarterly report, first quarter, 1989. Report for 1 January 1989-31 March 1989, 15:2158 (R;US)
Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan supplemental environmental data report. Volume 1. Trial trip sampling results. Report for 1 January 1988-31 March 1989, 15:2159 (R;US)
Unocal Parachute Creek shale-oil Program. Environmental Monitoring Plan quarterly report, fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2157 (R;US)

UOP, Inc., Des Plaines, IL (USA)
Upgrading of light Fischer-Tropsch products: Quarterly report No. 6, January 1, 1988–March 31, 1988, 15:2264 (R;US)
Upgrading of light Fischer-Tropsch products: Quarterly report No. 7, April 1, 1988–June 30, 1988, 15:2265 (R;US)

Urban Mass Transportation Research Information Service, Washington, DC (USA)
Urban Transportation Abstracts. Volume 7, 1988. Report for September 1988-February 1989, 15:2712 (R;US)

USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (USA). Office of Industrial Programs
Steel initiative: Development of superplastic steel processing: First annual progress report, March 15, 1988–March 15, 1989, 15:2827 (R;US)

USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA)
Technical Safety Appraisal of the Fast Flux Test Facility, Westinghouse Hanford Company, 15:2514 (R;US)

USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Planning and Environment
The directory of US coal and technology export resources, 15:2102 (R;US)

USDOE Assistant Secretary for Management and Administration, Washington, DC (USA). Employee Development and Training Div.
Technical skills training program: Program management, project management, procurement and assistance, 15:4489 (R;US)

USDOE Assistant Secretary for Nuclear Energy, Washington, DC (USA)
1988 annual report on low-level radioactive waste management progress, 15:2187 (R;US)

USDOE Assistant Secretary for Policy, Planning and Analysis, Washington, DC (USA). Office of Policy Integration
Assessment of costs and benefits of flexible and alternative fuel use in the US transportation sector: Technical report three: Methanol production and transportation costs, 15:2618 (R;US)

USDOE Bonneville Power Administration, Portland, OR (USA)
Electricity use in the Pacific Northwest: Utility historical sales by sector, 1988 and preceding years, 15:2643 (R;US)
Radon monitoring results from BPA's Residential Weatherization Program: Report No. 10, 15:2665 (R;US)
Radon monitoring results from BPS's Residential Conservation Programs: Report No. 11, 15:2667 (R;US)

USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife
Quantification of Hungry Horse Reservoir water level needed to maintain or enhance reservoir fisheries: Methods and data summary, 1983–1987, 15:2278 (R;US)
State of Idaho augmented anadromous fish health monitoring: Annual report, FY 1988, 15:2281 (R;US)

USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Resource Management
Northwest Residential Radon Standard: Volume 1, Project report, 15:2668 (R;US)
Northwest residential radon standard: Volume 2, Comment letters, 15:2669 (R;US)

USDOE Bonneville Power Administration, Portland, OR (USA). Office of Energy Resources
Research projects in residential technology, 15:2606 (R;US)

USDOE Bonneville Power Administration, Portland, OR (USA). Office of the Senior Assistant Administrator for Power Facilities
Research and Development report: Fiscal years 1987–1988, 15:2607 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels
Electric power monthly, August 1989, 15:2634 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use
Household energy consumption and expenditures, 1987: Part 1, National data, 15:2672 (R;US)
International energy annual, 1988, 15:2630 (R;US)
Short-term energy outlook: Quarterly projections, 15:2623 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas
Natural gas monthly, August 1989, 15:2629 (R;US)
Petroleum marketing monthly, 15:2125 (R;US)
Petroleum supply monthly, August 1989, 15:2628 (R;US)
Statistics of interstate natural gas pipeline companies, 1988, 15:2149 (R;US)

USDOE Morgantown Energy Technology Center, WV (USA)
Proceedings of the natural gas R&D contractors review meeting, 15:2142 (R;US)

USDOE Nevada Operations Office, Las Vegas, NV (USA). Office of External Affairs
Announced United States nuclear tests, July 1945–December 1988, 15:3388 (R;US)

USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)
OCRWM program elements change control procedures, 15:2188 (R;US)

USDOE Office of Energy Research, Washington, DC (USA)
The ultimate structure of matter: The US High Energy Physics Program from the 1950s through the 1980s, 15:3943 (R;US)

USDOE Office of Energy Research, Washington, DC (USA). Office of Health and Environmental Research
Carbon dioxide and climate: Summaries of research in FY 1989, 15:3409 (R;US)

USDOE Office of Energy Research, Washington, DC (USA). University and Industry Programs Div.
Guide for the preparation of applications for the University Research Instrumentation Program, 1990, 15:2608 (R;US)

USDOE Office of Inspector General, Washington, DC (USA). Capital Regional Office
Implementation of the land-based national telecommunications networks, 15:4537 (R;US)

USDOE Office of Policy, Planning and Analysis, Washington, DC (USA)
Energy conservation trends understanding the factors that affect conservation gains in the US economy, 15:2644 (R;US)

USDOE Pittsburgh Energy Technology Center, PA (USA)
Enhancement of surface properties for coal benefication: Progress report, August 1, 1989–September 30, 1989, 15:2056 (R;US)

USDOE, Washington, DC (USA)
Agreement between the USSR State Committee on the Use of Nuclear Power and the Department of Energy of the USA regarding joint studies in the field of controlled thermonuclear fusion and plasma physics, 15:4403 (TG;US)
Basic research results on controlled thermonuclear fusion and plasma physics in the USSR between July 1987 and July 1988, 15:4400 (TG;US)
Construction standards and practices, SNiP II-7-81: Part 2, Design standards: Chapter 7, Construction in seismic regions, 15:3806 (TG;US)
Contribution to atmospheric pollution of the activities of CSI Italsider in Bagnoli, 15:3415 (TG;US)
On economics of hot dry rock geothermal power station, 15:2353 (TG;US)
Status of work on TSP, T-15 and other OTR units, 15:4401 (TG;US)
The solitude of a determined inventor, 15:2784 (TG;US)
The status of work on the ITER project in the USSR, 15:4402 (TG;US)
Thiourea derivatives: Process for their production and for their use for neutron capture therapy of malignant melanomas, 15:3618 (TG;US)

Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)
List of publications 1988, 15:4496 (R;CS;In Czech, English)

Utah Univ., Salt Lake City, UT (USA)
Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 8, June 15, 1989–September 15, 1989, 15:2021 (R;US)
Field-flow fractionation in the analysis of energy-related materials: Final report, April 1, 1986–March 31, 1989, 15:3545 (R;US)

Utah Univ., Salt Lake City, UT (USA). Dept. of Fuels Engineering
Comprehensive characterization studies of sulfided molybdenum catalysts: Final progress report, 15:2828 (R;US)

Utah Univ., Salt Lake City, UT (USA). Dept. of Mining Engineering
Methane drainage from gassy Western US coal seams, 15:2083 (R;US)

V

Valley Research Corp., Van Nuys, CA (USA)
Development of an inventory of materials potentially sensitive to ambient atmospheric acidity in the South Coast Air Basin. Final report, 15:3558 (R;US)

Valparaiso Univ., IN (USA)
[A high sensitivity search for MU Gamma: The Mega experiment at LAMPF]: Progress report, January 15, 1989–October 15, 1989, 15:3952 (R;US)

Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)
Combustion of fixed-bed in grate firing, 15:3115 (R;FI;In Finnish)
Ecological aspects of lake regulation in Northern Finland. Part 2. Geomorphology and vegetation of the littoral zone, 15:2287 (R;FI;In Finnish)
Ecological aspects of lake regulation in northern Finland. Part 3. Macrozoobenlhos and feeding of fish, 15:2288 (R;FI;In Finnish)
Ecological aspects of lake regulation in northern Finland. Part 4. Spawning and the survival of the young fish, 15:2289 (R;FI;In Finnish)
Ecological aspects of lake regulation in Northern Finland. Part 5. Regulation practices and ecological effects, 15:2290 (R;FI;In Finnish)
Efficiency measurements of ventilation, 15:2705 (R;FI;In Finnish)
Electricity production at fuel cell power plants, 15:3252 (R;FI;In Finnish)
Evaluation of the thermal performance of the building envelope of existing buildings, 15:2707 (R;FI;In Finnish)
Frost resistance of concrete in artic offshore structures, 15:2755 (R;FI;In Finnish)
Heating energy flexibility of dwellings, 15:2706 (R;FI;In Finnish)
Qualitative modeling and control of combustion, 15:3251 (R;FI;In Finnish)
Sonic pyrometry in furnaces. Fundamentals, 15:3253 (R;FI;In Finnish)

Valtion Teknillinen Tutkimuskeskus, Jyvaeskylae (Finland). Polttoaine- ja Polttotekniikan Lab.
Calculation of peat production expenses, 15:2088 (R;FI;In Finnish)
Development of a mesuring method for the efficiency of milled peat production, 15:2089 (R;FI;In Finnish)
Development of a moisture meter for milled layer, 15:2087 (R;FI;In Finnish)
Development of the method for measuring the thickness of a milled peat layer, 15:2090 (R;FI;In Finnish)

Verein Deutscher Ingenieure (VDI) - Gesellschaft Energietechnik, Duesseldorf (Germany, F.R.)
Options and techniques for enhanced waste heat recovery in small- and medium-sized enterprises. A guideline, 15:2731 (R;DE;In German)

Vereinigung Industrielle Kraftwirtschaft (VIK) e.V., Essen (Germany, F.R.)
Options and techniques for enhanced waste heat recovery in small- and medium-sized enterprises. A guideline, 15:2731 (R;DE;In German)

Versar, Inc., Springfield, VA (USA)
Best demonstrated available technology (BDAT) background document for organophosphorous wastes, 15:2766 (R;US)
Best demonstrated available technology (BDAT) background document for phthalate wastes, 15:2767 (R;US)
Best demonstrated available technology (BDAT) background document for K009 and K010, 15:2768 (R;US)
Best demonstrated available technology (BDAT) background document for K011, K013, and K014. Final report, 15:2769 (R;US)
Best demonstrated available technology (BDAT) background document for cyanide wastes, 15:2770 (R;US)
Best demonstrated available technology (BDAT) background document for K043. Final report, 15:2771 (R;US)

Versuchsgrubengesellschaft m.b.H., Dortmund (Germany, F.R.)
Investigation of explosion with delayed start ($\geq$ 150 m) and methods of prevention. Final report, 15:2104 (R;DE;In German)

Versuchsgrubengesellschaft m.b.H., Dortmund (Germany, F.R.). Versuchsgrube Tremonia
VG annual report 1988. Activity report of the Versuchsgrubengesellschaft mbH, Versuchsgrube Tremonia in Dortmund, 15:2086 (R;DE;In German, English)

VFL Technology Corp., Malvern, PA (USA)
Use of ash in highway construction: Delaware demonstration project: Final report, 15:2069 (R;US)

Vind-Syssel A.M.B.A., Jerslev (Denmark)
Windmills standing on the sea bed at Dvalegrunden. Draft project, 15:2364 (R;DK;In Danish)

Virginia Commonwealth Univ., Richmond, VA (USA). Dept. of Chemistry
Sulfur dioxide removal from flue gases by supported copper and iron absorbents: Final technical report, May 16, 1986-December 31, 1988, 15:2068 (R;US)

Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA)
The parallel performance of Schwarz splitting, 15:4508 (R;US)

Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Dept. of Computer Science
Parallel mathematical software: Technical progress report, September 16, 1988–February 14, 1990, 15:4513 (R;US)

Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)
Recent decommissioning experiments - a literature survey. Quarterly report 3. quarter 1987, 15:2436 (R;FI;In Finnish)

Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia)
Abstracts of 14th radiation hygiene days, 15:4191 (R;CS;In Czech, Slovak)

W

Washington State Energy Office, Olympia, WA (USA)
Northwest Residential Radon Standard: Volume 1, Project report, 15:2668 (R;US)
Northwest residential radon standard: Volume 2, Comment letters, 15:2669 (R;US)

Washington Univ., Seattle, WA (USA)
Rapid inversion of multi-dimensional magnetotelluric data, 15:3805 (R;US)
Washington Univ., Seattle, WA (USA). Dept. of Environmental Health
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)
Washington Univ., Seattle, WA (USA). Dept. of Physics
Chiral symmetry restoration and quasi-elastic electron-nucleus scattering, 15:4019 (R;US)
Neutrino disintegration of deuterium, 15:3985 (R;US)
Space-time symmetries in nuclei, 15:4127 (R;US)
Status of time reversal invariance, 15:4018 (R;US)
The b_1 structure function and nuclear pions, 15:4126 (R;US)
Washington Univ., Seattle, WA (USA). Dept. of Statistics
Are ozone exceedance rates decreasing? Comment on extreme value analysis of environmental time-series: An application to trend detection in ground-level ozone. Technical report, 1 January-31 July 1989, 15:3401 (R;US)
Washington Univ., Seattle, WA (USA). Inst. for Nuclear Theory
[Nuclear theory]: Annual progress report, 15:4128 (R;US)
Waugh Controls Corp., Chatsworth, CA (USA)
Wide-range fuel flowmeter. Phase 2. Final report, 4 June 1986-3 February 1988, 15:2121 (R;US)
West Virginia Univ., Morgantown, WV (USA). Dept. of Mechanical and Aerospace Engineering
A study of coal particle shape and three-body wear: Quarterly report, August–October 1989, 15:2057 (R;US)
Western Research Inst., Laramie, WY (USA)
A solid-state NMR study of condensation/retrograde reactions during coal liquefaction: Quarterly progress report, July 1–September 30, 1989, 15:2023 (R;US)
Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the fourth quarterly, July 1, 1989–September 30, 1989, 15:2017 (R;US)
Westinghouse Electric Corp., Carlsbad, NM (USA)
Quality assurance guidance for TRUPACT-II [Transuranic Package Transporter-II] payload control, 15:2189 (R;US)
Westinghouse Electric Corp., Carlsbad, NM (USA). Engineering and Repository Technology Dept.
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 1, 15:2190 (R;US)
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 2, 15:2191 (R;US)
Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.
Waste Isolation Pilot Plant (WIPP) TRU waste shipment dry run preoperational checkout plan, 15:2192 (R;US)
Westinghouse Hanford Co., Richland, WA (USA)
Computerized Adaptive Testing, 15:4532 (R;US)
Recent plutonium metal production experience at Hanford, 15:2171 (R;US)
Westinghouse Savannah River Co., Aiken, SC (USA)
Improved neutron monitor systems for Savannah River Site separations facilities, 15:2165 (R;US)
Mixing times during the stirring of gas-charged viscous liquids (Part 3), 15:2756 (TJ;US)
Studies of the homogenization of structurally viscous and viscoelastic liquids in stirring containers, 15:2757 (TJ;US)
Wind Energy Group Ltd., Southall (UK)
Adaptive pitch control for power regulation of the MS-2 wind turbine, 15:2363 (R;GB)
WEG MS-2 stall-regulated rotor study, 15:2362 (R;GB)
Wintershall A.G. Erdoelwerke, Barnstorf (Germany, F.R.)
Analysis, development and investigations into phase behaviour of surfactant systems for de-oiling high-salinitiy reservoirs with reference to the Bockstedt field of Wintershall AG. Final report, 15:2110 (R;DE;In German)
Wisconsin Dept. of Natural Resources, Madison, WI (USA). Bureau of Solid Waste Management
Wisconsin waste reduction and recovery plan, 15:2745 (R;US)
Wisconsin Univ., Madison, WI (USA)
Ceramics for transportation engines - siren or solution, 15:2782 (R;US)
Wisconsin Univ., Madison, WI (USA). Dept. of Physics
Development of polarized ion beams and polarized gas targets: Final scientific report, 15:3286 (R;US)
Wisconsin Univ., Madison, WI (USA). Water Resources Center
Use of ground-penetrating radar to define recharge areas in the Central Sand Plain. Technical completion report, 15:3560 (R;US)
Woods Hole Oceanographic Institution, MA (USA)
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report, 15:3573 (R;US)
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report, 15:3574 (R;US)
Wright Research and Development Center, Wright-Patterson AFB, OH (USA)
Properties of F-34 (JP-8) fuel for 1988. Summary report, January-December 1988, 15:2119 (R;US)

Y

Y-ARD Ltd., Glasgow (UK)
Electricity producing renewable energy technologies common costing methodology. V. 2, 15:2647 (R;GB)

Personal Author Index

Authors' surnames are indexed in the form appearing in the publication cited; given names generally have been reduced to initials. For documents with multiple authors, each author name is indexed. The entry for a primary author (first author listed on an abstracted document) includes the full document title and citation number. Entries for other authors provide a cross-reference to the primary author. Also included is information on the document type, country of publication, and the document language listed in parentheses in the format (J;FR;In French and English). Accent marks are not input because of computer alphabetization. Spelling and transliteration follow standard conventions.

A

Aagaard Madsen, H., Derivation of three-dimensional airfoil data on the basis of experiment and theory, 15:2372 (RA;DK)
Results from actuator surface theory applications on wind turbine rotors, 15:2376 (RA;DK)
See Friis Pedersen, T., 15:2373

Aamand, L.E., Ammonia addition for NO_x reduction in fluidized bed boilers, 15:2074 (R;SE)
Emission of nitrogen oxide from a circulating fluidized bed boiler - the influence of design parameters, 15:3466 (R;SE)

Aamodt, R.E., Fundamental studies of fusion plasmas: Annual performance report, 15:4307 (R;US)

Abakumov, G.Z., *See* Ovchinnikov, V.A., 15:3739

Abd El-Sattar, A. Dabbou, Projective cohomology over a chain complex, 15:4279 (R;XA)

Abdullah, T., *See* Bulanov, S.V., 15:4313

Abe, D.K., *See* Pincosy, P.A., 15:4445

Abe, Hirotada, Particle simulation on high power ECH current drive, 15:4338 (RA;JP)

Aboul-Enein, A., *See* Tossi, A.B., 15:3733

Abraham, M.M., *See* Boldu O., J.L., 15:3023

Abramyan, S.G., *See* Berdov, B.A., 15:3737

Abrao, A., *See* Aquino, A.R. de, 15:3103
See Atalla, L., 15:2162
See Carvalho, F.M.S. de, 15:3051
See Pires, M.A.F., 15:3050
See Silva Queiroz, C.A. da, 15:2161, 15:3049

Abratt, V., Induction and repair of DNA strand-breaks in Bacteroides fragilis, 15:3598 (R;US)

Acedo, G.N., *See* Sandhu, S.S., 15:3782

Achenbach, W., Search for a fission fragment anisotropy signal after optical spin exchange pumping on ^{242m}Am, 15:4117 (RA;DE;In German)

Ackerhalt, J.R., *See* Milonni, P.W., 15:3922

Ackerman, B., *See* Albright, S.P., 15:2306

Ackerman, G.D., *See* Inoue, T., 15:4439
See Kwan, J.W., 15:3305

Ackermann, H., *See* Sulzer, G., 15:4228

Adams, F.D., Light sensitivity of .13 mm thick LiF-teflon thermoluminesence dosimeters, 15:4185 (R;US)

Adams, J.B., *See* Foiles, S.M., 15:2883

Adams, J.H. Jr., Current models of the intensely ionizing particle environment in space, 15:3853 (RA;US)
See Mewaldt, R.A., 15:3852
See Shea, M.A., 15:3851

Adams, T.D., *See* Cooke, D.W., 15:4256

Adamson, M.G., *See* Kassner, M.E., 15:2869

Adcock, J.L., *See* Bare, J.C., 15:3436

Adewumi, M.A., *See* Bezilla, M., 15:2141

Adinarayana, M., *See* Bothe, E., 15:3728

Adkins, D.R., Design considerations for heat-pipe solar receivers, 15:2327 (BA;US)

Adler, M.V., *See* Gant, K.S., 15:2512

Adler, P.H., *See* Kassner, M.E., 15:2869

Adler, S., Understanding the dynamics of innovation in urban transit. Final report on Phase 2, 15:2714 (R;US)

Aggarwal, S.K., *See* Marathe, S.G., 15:2163

Ahlers, H.W., *See* Millar, J.D., 15:3684

Ahlf, J., Irradiation programs to establish the safety margins of German licensing rules related to RPV steel embrittlement, 15:2465 (R;DE)
The consideration of irradiation embrittlement of RPV steels in German licensing rules as compared to recent results of irradiation experiments, 15:2835 (R;DE)

Ahlin, K., *See* Thor, S.E., 15:2386

Ahlstroem, M., Energy management, 15:2754 (R;SE;In Swedish)

Ahmad, I., *See* Moore, E.F., 15:4107

Ahn, B., Auroral energy deposition over the polar ionosphere during substorms. Technical report, 15:3882 (R;US)

Aho V.J., *See* Lind, T., 15:2090

Aho, V.J., Development of a moisture meter for milled layer, 15:2087 (R;FI;In Finnish)

Ahonen, M., *See* Hillebrand, K., 15:2088

Ahrenkiel, R.K., *See* Olson, J.M., 15:3005

Ahsan, J., Minimal prime ideals in semigroups without nilpotent elements, 15:4278 (R;XA)
On prime ideals and associated spectrum of BCK-algebras, 15:4280 (R;XA)
On pure radical in semigroups with zero, 15:4274 (R;XA)

Aichelin, J., Rapidity distribution and scaling violation in a statistical approach to string fragmentation, 15:3993 (RA;DE)
See Bohnet, A., 15:4149
See Kurihara, Y., 15:3994
See Schulze, H.J., 15:3995

Aida, H., *See* Goguen, J.A., 15:4500

Aiken, R.J., *See* Buck, J.W., 15:2229

Allor, W.H. III, *See* Joyce, J.P., 15:2650, 15:2651

Akagi, Katsumi, *See* Koori, Norihiko, 15:4427

Akasofu, S., *See* Ahn, B., 15:3882

Akdeniz, Z., Local coordination of polyvalent metal ions in molten halide mixtures, 15:4218 (R;XA)

Akel, M., Study of hypernuclei via (π^+, K^+) reactions at KEK, 15:3957 (R;JP)

Akers, D.W., Fission product relocation and behavior in the TMI-2 reactor vessel, 15:2486 (R;US)
Verification of the ORIGEN2 code analysis for the TMI-2 reactor core, 15:2485 (R;US)

Akhtar, G., Resistivity measurements of superconducting materials. Master's thesis, 15:2932 (R;PK)

Akhurst, K.N., Ageing kinetics of CF3 cast stainless steel in the temperature range 300°C to 400°C, 15:2816 (R;GB)

Akiba, Masato, *See* Matsuoka, Mamoru, 15:4422

Akimoto, K., Parametric instabilities of Langmuir waves in weak/moderate magnetic fields, 15:4377 (J;US)

Akimune, H., *See* Tsumori, K., 15:2851

Aksan, S.N., *See* Modro, S.M., 15:2551

Alarid, J.E., *See* Greiner, N.R., 15:3155

Alasaarela, E., Ecological aspects of lake regulation in Northern Finland. Part 5. Regulation practices and ecological effects, 15:2290 (R;FI;In Finnish)
See Hellsten, S., 15:2287
See Tikkanen, P., 15:2288

Alberich, T., Deep-inelastic myon-nucleus scattering at the CERN SPS; EMC and NMC Collaboration, 15:3956 (RA;DE;In German)

Albers, R.C., *See* Norman, M.R., 15:4248

Albert, P.E., *See* Silva, G.R. da, 15:4224

Albertoni, C.R., *See* Chen, Z.Y., 15:3097

Albright, S.P., High-efficiency large-area CdTe modules: Annual subcontract report, 1 July 1988–30 June 1989, 15:2306 (R;US)
Albuquerque, M. da P.P., Angular dependence of parallels plates ionization chambers for x radiation, 15:3337 (R;BR;In Portuguese)
Alcock, C., *See* Frieman, J.A., 15:3849
Alde, D., Study of $\omega\omega$ systems produced in 38 GeV/c $\pi^- p$ collisions, 15:3969 (J;US)
Alden, D., *See* Stouffer, D.C., 15:2842
Alekseenko, K.K., *See* Simbirtseva, L.P., 15:3654
Alexander, D.J., A semiautomated computer-interactive dynamic impact testing system, 15:4397 (R;US)
See Nanstad, R.K., 15:3215
Alexander, S.S., Near-surface neotectonic deformation associated with seismicity in the northeastern United States, 15:3814 (R;US)
Allen, D.H., Establishment of a viable population of red-cockaded woodpeckers at the Savannah River Site: Progress report, FY 1989, 15:3492 (R;US)
Allen, J.F., Northeast Artificial Intelligence Consortium annual report for 1987. Volume 7. Part A. Time oriented problem solving. Interim report, December 1986-December 1987, 15:4499 (R;US)
Allen, P.B., *See* Sanborn, B.A., 15:2885
Allen, S.L., *See* Hooper, E.B., 15:4352
Allred, R.E., *See* Fullerton, R., 15:3226
Allsup, J.R, *See* Gurney, M.D., 15:2788
Almeida, C.E. de, Description of the objectives and activities of Radioprotection and Dosimetry Institute - IRD, 15:4493 (R;BR;In Portuguese)
Almeida, M.C.M. de, Evaluation of the utilization of neutron activation analysis for measuring non-irradiated nuclear fuels for safeguards, 15:2167 (R;BR;In Portuguese)
See Menlove, H.O., 15:2168
Almeida, S.G. de, *See* Araujo, R.M.S. de, 15:3054
See Menlove, H.O., 15:2168
Almeida, S.H. de., Study of niobium corrosion in alkaline medium, 15:2837 (R;BR;In Portuguese)
Alpert, D.J., An assessment of the optical performance of stretched-membrane mirror modules, 15:2328 (BA;US)
Altevogt, H., *See* Stolterfoht, N., 15:4071
Althaus, E., Reactions and interactions of the reservoir rock with heat exchange media in the hot dry rock process: A case study in the Falkenberg granite, 15:2359 (R;DE;In German)
Amann, J.F., *See* Akei, M., 15:3957
See Oothoudt, M.A., 15:3297
Ambrose, R.B., *See* Stefan, H.G., 15:3544
Ament, G., *See* Ginsberg, A.P., 15:2558
Ames, F., *See* Achenbach, W., 15:4117
Amsler, C., Low energy $\bar{p}p$ physics, 15:3960 (R;US)
Amusa, A., *See* Segel, R.E., 15:4081
Anand, R.P., Progress report on nuclear data activities in India for the period from July 1987 to December 1988, 15:4062 (R;IN)
and others, *See* Alde, D., 15:3969
See Bernstein, E.M., 15:3926
See Brown, C.M., 15:3925
See Harris, J.H., 15:4372
See Krisch, A.D., 15:3281
See Marshall, F.J., 15:4484
See Shaw, N.M., 15:3970
See Shen, Z., 15:2960
Andersen, B., Noise from larger windmills. Principles for the construction of windmills that produce less noise, 15:2380 (R;DK;In Danish)
Andersen, S., Pilot project for a larger solar heating system with seasonal heat storage. Further documentation of borehole storage yield and economy, 15:2352 (R;DK;In Danish)
Anderson, A.C., *See* Lichtenwalner, D.J., 15:2898
Anderson, D., *See* Wong, I., 15:3807
Anderson, J., Internal film receiver design and systems assessment, 15:2323 (BA;US)
Anderson, J.L., *See* Golden, D.W., 15:2520
See Sze, D.K., 15:4393
Anderson, K., *See* Goldman, C.A., 15:2624
Anderson, L.W., Development of polarized ion beams and polarized gas targets: Final scientific report, 15:3286 (R;US)
Anderson, M.P., *See* Bohling, G.C., 15:3560
Anderson, O.A., *See* Kwan, J.W., 15:3305
Anderson, P.G., *See* Lister, D.H., 15:2445
Anderson, R.A., Surface and bulk properties which influence ion-beam hydrogenation of silicon, 15:2852 (R;US)
Anderson, R.F., *See* Biscaye, P.E., 15:3817
Anderson, R.G., *See* Rosocha, L.A., 15:4453
Anderson, R.J.M., *See* Hamilton, J.C., 15:2879
Anderson, R.R., CRRES (Combined Release and Radiation Effects Satellite) SAPCERAD Plasma Wave Experiment. Final report, 20 April 1982-30 June 1988, 15:3883 (R;US)
Anderson, T., Local government techniques for inland wetlands protection. Technical report, 15:3585 (R;US)
Anderson, T.D., ORNL [Oak Ridge National Laboratory] 89, 15:2610 (R;US)
Anderson-Carnahan, L., *See* Mount, D.I., 15:3550
Andersson, A., *See* Nilsson, Aa., 15:3565
Andersson, B.Aa., *See* Johnsson, F., 15:2101
Andersson, T., *See* Nilsson, Aa., 15:3565
Ando, A., *See* Menten, J.O.M., 15:3686
Andrew, M.G., *See* Zagrodnik, J.P., 15:2587
Andrews, B.M., *See* Trofe, T.W., 15:2143
Andriamonje, S., *See* Stolterfoht, N., 15:4071
Angelini, P., *See* McHargue, C.J., 15:2908
Anger, K., Conduct of local dosimetry in X-ray diagnosis, 15:4197 (R;DD;In German)
Anghinolfi, M., *See* Viesti, G., 15:4091
Antal, J.J., Neutron-radiography system for field use. Final report, 15:3212 (R;US)
Antaya, T.A, *See* Lyneis, C.M., 15:3306
Anthony, L., Kinetic paths of B2 and DO_3 order parameters: Theory, 15:2871 (J;US)
Kinetic paths of B2 and DO_3 order parameters: Experiment, 15:2872 (J;US)
Antonini, R., Fluorescence and optical absorption in spodumene, 15:2971 (R;BR;In Portuguese)
Antonsen, T.M., *See* Levush, B., 15:3169
Anweiler, B., *See* Krankowsky, D., 15:3821
Aoki, S., Neutron electric dipole moment in lattice QCD, 15:4053 (J;US)
Aplan, F.F., *See* Chander, S., 15:2056
Appelbaum, J., Solar radiation on Mars, 15:2292 (R;US)
Appleman, E., *See* Porter, L.C., 15:4252
Appleton, B.R., Method of fabricating optical waveguides by ion implantation doping, 15:2964 (P;US)
See Anderson, T.D., 15:2610
April, R., Best demonstrated available technology (BDAT) background document for organophosphorous wastes, 15:2766 (R;US)
Best demonstrated available technology (BDAT) background document for phthalate wastes, 15:2767 (R;US)
Best demonstrated available technology (BDAT) background document for K009 and K010, 15:2768 (R;US)
Best demonstrated available technology (BDAT) background document for K011, K013, and K014. Final report, 15:2769 (R;US)
Best demonstrated available technology (BDAT) background document for cyanide wastes, 15:2770 (R;US)
Best demonstrated available technology (BDAT) background document for K043. Final report, 15:2771 (R;US)
Methodology for developing best demonstrated available technology (BDAT) treatment standards, 15:2765 (R;US)
Aquino, A.R. de, Obtention of crystals feom thorium nitrate using microwave as heating source, 15:3103 (R;BR;In Portuguese)
Arai, T., Natural analogue study of volcanic glass. A case study of basaltic glasses in pyroclastic fall deposits of Fuji volcano, Japan, 15:3804 (R;JP)
Arai, Yasuo, Fabrication of uranium-plutonium mixed carbide fuel pins for JMTR irradiation capsules, 84F-10A, 84F-12A and 87F-2A, 15:2461 (R;JP;In Japanese)
Arakawa, E.T., The optical properties of beryllium, 15:2830 (R;US)
Arasteh, D., *See* Reilly, S., 15:2342
Arasteh, D.K., A versatile procedure for calculating heat transfer through windows, 15:2690 (R;US)

Arastoopour, H., Continuation of gas technology, basic research, and education. Final report, August 15, 1985-August 15, 1988, 15:2137 (R;US)
Arau, B.A., *See* Fraas, L.M., 15:2319
Araujo, B.F. de., *See* Yamaura, M., 15:3052
Araujo, J.A. de, *See* Aquino, A.R. de, 15:3103
Araujo, J.A. de., *See* Brandao Filho, D., 15:2169
Araujo, R.M.S. de, Evaluation of the results from uranium chemical analysis by potentiometric tritation method for safeguards utilization through intercomparison programs, 15:3054 (R;BR;In Portuguese)
Ardouin, D., *See* Quebert, J., 15:4063
Arendt, P.N., *See* Cooke, D.W., 15:2921
Argo, B.E., *See* Gouge, M.J., 15:4388
Argueello, J.G., 3D thermal stress analysis of WIPP [Waste Isolation Pilot Plant] Room T RH TRU [Remote Handled Transuranic] experiments, 15:2235 (R;US)
Arko, A.J., Possible FERMI liquid behavior of 5f electrons in UPt_3 at $T \gg T_K$, 15:4232 (R;US)
Armelin, M.J.A., Simultaneous determination of some nutrient elements in five varieties of maize by instrumental neutrons activation analysis, 15:3048 (R;BR;In Portuguese)
Armstrong, P., *See* Arko, A.J., 15:4232
Armstrong, T.P., *See* Feynman, J., 15:3854
Arnold, C. Jr., Low density microcellular carbon foams and method of preparation, 15:3036 (P;US)
Arnold, F., Technical and methodical developments, 15:3350 (RA;DE;In German)
Arnold, W., The Heidelberg heavy ion test storage ring, 15:3321 (RA;DE;In German)
Aro, Ilari., Studies of potential severe accidents in Finnish nuclear power plants. Quarterly report 3. quarter 1987, 15:2450 (R;FI)
Aronson, A.L., *See* Van Tuyle, G.J., 15:2496
Artemova, N.A., Local radiation injuries after radiotherapy on radical program in patients with locally disseminated lung carcinoma subjected to exploratory thorocotomy, 15:3743 (RA;SU;In Russian)
Artemova, N.A. and other, *See* Shevko, V.A., 15:3665
Arutyunyan, L.G., *See* Strakh, A.G., 15:3673
Arvizu, D.E., Crystalline silicon photovoltaic cell technology: Meeting the challenge for utility power, 15:2313 (BA;US)
Arya, V.K., Finite element implementation of viscoplastic models, 15:3244 (RA;US)
Asay, J.R., Performance characteristics of a three-stage railgun, 15:3220 (R;US)
Asbell-Clarke, J.E., Nuclear electric propulsion for near-term space missions, 15:2652 (BA;US)
Asbury, J.G., *See* Minkov, V., 15:2758
Aschenbach, J., *See* Storck, R., 15:2198
Ashby, M.F., *See* Campbell, A.M., 15:3120
Ashcroft, N.W., Dynamically compressed metals - theory. Final report, 1 February 1986-30 April 1989, 15:4200 (R;US)
Ashida, T., *See* Miyahara, K., 15:2224
Ashley, G.M., *See* McLaughlin, F.B., 15:3551
Ashley, P.R., *See* Appleton, B.R., 15:2964
Ashwill, T.D., Initial structural response measurements for the Sandia 34-meter VAWT test bed, 15:2406 (BA;US)
See Carne, T.G., 15:2408
Askins, M.C., *See* Roberts, B.W., 15:2410
Aslam, M., Note on p-semisimple BCI-algebras, 15:4275 (R;XA)
Assouline, M., *See* Van Kote, F., 15:2197
Astruc, J.M., *See* Hoffman, H., 15:2472
Astrup, P., *See* Olsen, A., 15:3110
Atalia, L., Use of uranium in filtrated from preparation process uranium tetrafluoride by umid via, 15:2162 (R;BR;In Portuguese)
Atallah, S., Dike insulation for LNG (liquefied natural gas) vapor mitigation. Topical report, September 1987-December 1988, 15:2154 (R;US)
Atcheson, J., *See* Stephan, D.G., 15:2595
Atkinson, A., Evolution of pH in a radwaste repository: internal reactions between concrete constituents, 15:2178 (R;GB)
Atkochyus, V.B., *See* Dzhevechka, I.I., 15:3642
See Mamontov, V.V., 15:3647
Attwood, D., Challenges for utilization of the new synchrotron facilities, 15:3266 (R;US)
Attwood, G.J., Method for predicting the impact velocity of a projectile fired from a compressed air gun facility, 15:3122 (R;GB)
Atwood, W.B., B physics at the Z^0 pole, 15:3966 (R;US)
Atzmony, U., *See* Bennett, L.H., 15:2812
Aubert, J.H., *See* Arnold, C. Jr., 15:3036
Auerbach, L.B., Experimental investigations in particle physics at intermediate energies: Performance report, December 1, 1988–December 31, 1989, 15:3951 (R;US)
Auflick, J.L., Human factors evaluation of electroluminescent display #1, 15:3126 (R;US)
August, R.A., High-efficiency fast-neutron detector. Memorandum report, 15:3329 (R;US)
Augustine, R.L., A single turnover (STO) characterization of supported palladium catalysts, 15:3082 (BA;US)
Aunzo, Z., The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 1, Text and main figures, 15:2355 (R;US)
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 2, Appendices A through E, 15:2356 (R;US)
Aurich, D., Elastic-plastic fracture mechanics analysis of a pressure vessel with an axial outer surface flaw. Technical report, 15:2531 (R;DE;In German)
Autin, B., General properties of an asymmetric B-factory lattice, 15:3273 (R;US)
Avens, L.R., Magnetic separation as a plutonium residue enrichment process, 15:2203 (R;US)
Avery, J.E., *See* Fraas, L.M., 15:2319
Awin, A.M., Positive energy bound states, 15:4132 (R;XA)
Awschalom, D.D., *See* Khachaturyan, K.A., 15:3010
Ayala, R.E., Advanced gas-turbine steam-injection program water treatment for steam-injected gas-turbine systems. Topical report, October 1987-March 1989, 15:2417 (R;US)
Ayoubi, I.S., Concentration profiles from lidar measurements in the presence of multiple scattering: the two-stream approximation, 15:3473 (J;US)
Ayra, R.R., Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 2, Semiannual report, February 1, 1988–July 31, 1989, 15:2305 (R;US)
See Carlson, D.E., 15:2303
See Catalano, A.W., 15:2304
Azevedo, H.L.P. de., Zirconium nitrate preparation and analytical method of zirconium determination in extraction experiments. pt.1, 15:3043 (R;BR;In Portuguese)
Azevedo, S.G., Interactive multidimensional data analysis and understanding, 15:4530 (R;US)
Azgui, F., Study of the structure of the transition nuclei ^{152}Dy, ^{154}Dy and ^{156}Er at high angular momentum, 15:4088 (R;FR;In French)
Aziz, M.J., Fundamentals of beam-solid interactions and transient thermal processing, 15:2857 (B;US)
See Lu, G.Q., 15:2995
See Tsao, J.Y., 15:3000
Azumi, M., *See* Kikuchi, M., 15:4333
Azumi, Masafumi, *See* Ozeki, Takahisa, 15:4425
See Tani, Keiji, 15:4340

B

Baba, Mamoru, Measurements of prompt fission neutron spectra and double-differential neutron inelastic-scattering cross sections for ^{238}U and ^{232}Th, 15:4119 (R;JP;In Japanese)
Baba, S., *See* Brandao Filho, D., 15:2169
Babich, N.P., *See* Demidchik, E.N., 15:3641
Baca, G., *See* Sciacca, F., 15:2543
Baca, R.G., *See* McElroy, D.L., 15:2186
Bacchetta, N., *See* Benvenuti, A., 15:3357
Bach, F.W., Development of a technique for dismantling geometric complicated and thick components of closed down nuclear power plants with the principle of arc-waterjet cutting. Final report, 15:2532 (R;DE;In German)
Bacher, A.D., *See* Segel, R.E., 15:4081
Backe, H., *See* Achenbach, W., 15:4117
See Kramp, J., 15:3344
Bacon, L.D., Microwave coupling phenomenology of pc [printed-circuit] boards, 15:3227 (R;US)

Bader, S.D., *See* Liu, C., 15:2822
Badirkhan, Z., Statistical mechanical models for liquid and amorphous structure in covalently bonded systems, 15:4217 (R;XA)
Badri, D., *See* Lechter, W., 15:2965
Baechler, M.C., Summary of residential environmental issues and program consistency, 15:2698 (R;US)
Bagwell, T.G., Comparisons of two-phase microgravity calculations using current and new flow regime maps in RELAP5, 15:3209 (J;US)
Bahnfleth, W.P., Three-dimensional modeling of heat transfer from slab floors. Final report, 15:2661 (R;US)
Bailey, R.S., *See* Hulse, C.O., 15:3367
Bailey, R.T., *See* Clark, G.A., 15:2096
Bain, J.W. Jr., *See* Moss, R.D., 15:2413
Bairstow, R., Particle physics experiments 1988, 15:3961 (R;GB)
Bak, P., *See* Lebed, A.G., 15:3011
Bakema, G.F., Experiences with the application of a solar boiler on a camping-site in Sint Maartenszee, Netherlands, 15:2333 (R;NL;In (In Dutch))
Baker, D.A., Population dose commitments due to radioactive releases from nuclear power plant sites in 1986, 15:2539 (R;US)
Baker, J.E., *See* Rothman, S.J., 15:2914
Baker, R.L., *See* Joyce, J.P., 15:2650, 15:2651
Balachandran, U., *See* Dees, D.W., 15:2655
Balachandran, Uthamalingam, *See* Dees, D.W., 15:2654
Baldwin, R.M., Process and analytical studies of enhanced low severity co-processing using selective coal pretreatment: Quarterly technical progress report, June–August, 1989, 15:2022 (R;US)
Bale, H.D., Role of porosity in supercritical fluid extraction of coal: Final technical report, 15:2060 (R;US)
Bales, K.S., Research and technology plans for FY 1989 and accomplishments for FY 1988, 15:2977 (R;US)
Balian, P., Ionizing radiations dosimetry: new results in the megagray range, 15:4184 (R;FR;In French)
Balik, C.M., Effects of acid deposition on painted wood substrates, 15:3432 (R;US)
Baltz, A.J., Deformed proximity potential for heavy ion reactions, 15:4123 (R;US)
Bane, K.L.F., Optimizing the average longitudinal phase of the beam in the SLC linac, 15:3276 (R;US)
Banerjee, P.K., *See* Wilson, R.B., 15:3238
Banks, B.A., *See* Swec, D.M., 15:2929
Banta, R.M., *See* Muench, H.S., 15:3474
Bapat, V.N., *See* Nambi, K.S.V., 15:4190
Barber, G.C., *See* Gouge, M.J., 15:4388
Barber, J.W., *See* Hearst, J.R., 15:3390
Barbour, J.C., *See* Pope, L.E., 15:2862
Bardeen, J.M., *See* Salopek, D.S., 15:3878
Bardsley, J.N., Relativistic dynamics of electrons in intense laser fields, 15:4384 (J;US)
Symmetric charge transfer to multiply charged ions, 15:3914 (J;US)
Bardsley, M.E.A., Measurements of the three components of the velocity in the intake ports of an I.C. engine, 15:2789 (B;US)
Bardychev, M.S., Local radiation injuries, 15:3736 (RA;SU;In Russian)
See Berdov, B.A., 15:3737
Bare, J.C., New chemical alternatives to chlorofluorocarbons and halons. Report for August 1988-February 1989, 15:3436 (R;US)
Barger, V., *Z*-boson bremsstrahlung in heavy-quark decay, 15:4014 (J;US)
Barinaga, C.J., *See* Smith, R.D., 15:3371
Barletta, W.A., *See* Shay, H.D., 15:3167
Barlow, G, *See* Chilenskas, A.A., 15:2586
Barnard, J.C., *See* Elliott, D.L., 15:2381
Barrett, T.J., Evaluation of fuel-cell technology for Coast Guard applications. Final report, 15:2653 (R;US)
Barry, B.J., *See* Lister, D.H., 15:2445
Bartlett, S., *See* Ketoff, A., 15:2646
See Wilson, D., 15:2622
Bartley, J., *See* Leadon, S.A., 15:3794
Bartlit, J.R., *See* Sze, D.K., 15:4393
Bartolotta, P.A., *See* Ellis, J.R., 15:2844
Barut, A.O., Pair production in an electric field in a time-dependent gauge, 15:4040 (R;XA)
QED based on self-energy: The relativistic $2S_{1/2}$ -> $1S_{1/2}+1\gamma$ decay rates of hydrogenlike atoms, 15:3888 (R;XA)
Baskes, M.I., Semiempirical modified embedded-atom potentials for silicon and germanium, 15:3024 (J;US)
Basore, P.A., PC-1D version 2: Enhanced numerical solar cell modeling, 15:2311 (BA;US)
Batalin, I.A., Generalized canonical quantization of dynamical systems with constraints and curved phase space, 15:4272 (R;XA)
Bates, J.L., Solid oxide fuel cells electrodes based on In_2O_3-$PRrO_{1.83}$-ZrO_2, 15:2659 (R;US)
Bathke, C.G., The TITAN oscillating-field current-drive system, 15:4463 (BA;US)
See Cooke, P.I.H., 15:4469
See Krakowski, R.A., 15:4342
Batstone, R., Safe disposal of hazardous wastes: The special needs and problems of developing countries. Volume 1-Volume 3. World Bank technical paper, 15:2750 (R;US)
Batty, C.J., Light kaonic and antiprotonic atoms, 15:3893 (R;GB)
Bau, K., *See* Poepel, H.J., 15:2760
Bauer, P., *See* Ender, C., 15:3343
Bauer, W., *See* Kohler, H.S., 15:4171
Bauer, W.F., Comparison of digestion procedures used for the determination of boron in biological tissues by ICP-AES [inductively-coupled, plasma-atomic emission spectroscopy], 15:3609 (R;US)
Baughcum, S.L., *See* Finch, F.T., 15:2271
Baum, D.R., *See* Augustine, R.L., 15:3082
Baum, J.W., *See* Tung, C.J., 15:3101
Baumann, H., Preparation of ^{60}cobalt sources by molecular plating, 15:2254 (RA;DE;In German)
Preparation of isotopically pure ^{48}Ca-targets by ion implantation in C-foils, 15:3292 (RA;DE;In German)
Target preparation, 15:3291 (RA;DE;In German)
Baumann, P., *See* Reich, H., 15:3290
Baumann, W., Collision-radiation recombination, 15:3345 (RA;DE;In German)
Dielectronic recombination, 15:3890 (RA;DE;In German)
Laser cooling, 15:3294 (RA;DE;In German)
Laser-induced electron-ion interaction, 15:3889 (RA;DE;In German)
Ultracold ion beam, 15:3293 (RA;DE;In German)
Baur, G., Effect of vacuum polarization on the sub-Coulomb ^{12}C-^{12}C scattering, 15:4077 (RA;DE;In German)
Baxi, C.B., *See* Smith, J.P., 15:4410
Baylor, L.R., *See* Gouge, M.J., 15:4388
See Shen, S.S., 15:4478
Bazell, C.J., *See* Cooper, C.A., 15:3123
Beachler, M.C., Summary of commercial conservation programs environmental issues and program consistency, 15:3517 (R;US)
Beard, K.B., *See* Moore, E.F., 15:4107
Beattie, W.H., *See* Finch, F.T., 15:2271
Beaty, K., Sliding seal materials for low heat rejection engines, 15:2783 (R;US)
Beaudry, B.J., *See* Kai, K., 15:2955
See Westrum, E.F. Jr., 15:3021
Becher, U., *See* Hall, B., 15:2888
Bechthold, P.S., *See* Weiller, B.H., 15:3091
Beck, M., Transition from quantum-noise-driven dynamics to deterministic dynamics in a multimode laser, 15:3183 (J;US)
Becker, D., *See* Sevilla, M.D., 15:3714
Becker, D.S., *See* Pastorok, R.A., 15:3561
Becker, H., *See* Ender, C., 15:3343
Becker, K., Quasielastic scattering of polarized ^{23}Na, 15:4097 (RA;DE;In German)
Single neutron transfer reactions induced by polarized ^{7}Li ions, 15:4136 (RA;DE)
Becker, S.A., The evolution of variable stars, 15:3870 (BA;US)
Beckmann, H., *See* Mewes, D., 15:2530
Becla, P., *See* Khachaturyan, K., 15:3029
Bednar, F., Energy calibration and quantitative analysis with ESCA, 15:3351 (RA;DE;In German)
Bedzyk, M.J., *See* Berman, L.E., 15:4239
Beeman, J.W., *See* Rondorf, D.W., 15:2279
Beers, L.V., Proceedings of the tau-charm factory workshop: Study of tau, charm and J/psi physics; development of high luminosity

esup +esup minus rings; design of esup +esup minus detectors for tau-charm physics, 15:3962 (R;US)
Beery, J.G., *See* Cooke, D.W., 15:2921
Begemann, F., *See* Chalkias, S., 15:3493
See Huenemohr, H., 15:4078
Behar, M., Nuclear solid state physics and technology, 15:4227 (RA;DE;In German)
Behling, H., *See* Sciacca, F., 15:2543
Behling, K., *See* Sciacca, F., 15:2543
Behra, N., *See* Kaul, R.K., 15:4036
Behroozi, F., Superconducting properties of a single-crystal sphere of $ErRh_4B_4$, 15:2954 (J;US)
Beiersdorfer, P., *See* Brown, C.M., 15:3925
Bekefi, G., *See* Leibovitch, C., 15:4366
Belanger, G., *See* Doncheski, M.A., 15:4015
Belendorff, K., *See* Fleckenstein, T., 15:2028
Belenkov, V.V., Possibilities of stomach X-ray examination in low exposure dose, 15:3633 (RA;SU;In Russian)
Belenkov, Yu.N., Diagnostic possibilities of MR-tomography in revealing and evaluation of hematoma state, 15:3626 (RA;SU;In Russian)
Belichenko, O.I., *See* Belenkov, Yu.N., 15:3626
Belka, H.G., The present-day situation of the mineral oil industry, 15:2126 (RA;DE;In German)
Belkacem, A., Interactions of fast atomic and molecular ions with matter, 15:4210 (R;US)
Stopping power and energy loss cross section of a point charge penetrating through a dense medium of bound electrons, 15:4205 (R;US)
Belkin, M., Treatment of laser-induced retinal injuries. Final report, 12 February 1985-31 January 1987, 15:3797 (R;IL)
Bell, G.L., *See* Harris, J.H., 15:4372
Bell, J.D., *See* Harris, J.H., 15:4372
Bell, M.G., *See* Park, H.K., 15:4350
Bell, W.K., Reverse Hopkinson bar testing, 15:3389 (R;US)
Bellissimo, D., *See* Crawford, N.M., 15:3607
Bellm, D., Preequilibrium emission of neutrons in central heavy-ion collisions at 15-20 MeV/A bombarding energy, 15:4086 (RA;DE;In German)
Bellmann, D., *See* Ahlf, J., 15:2465, 15:2835
Belton, M.J.S., Time-variable phenomena in the Jovian system, 15:3867 (R;US)
Bemis, C.B., *See* Oothoudt, M.A., 15:3297
Bench, M.W., In situ tem observations of heavy ion damage in gallium arsenide, 15:2991 (BA;US)
Benchehida, M., *See* Berthoud, T., 15:3040
Bender, E., Calculation of β^--decay half-lives by the proton-neutron QRPA, 15:4139 (RA;DE;In German)
See Muto, K., 15:4138
Benedett, A.V., *See* Naal, Z., 15:3053
Benes, S.E., *See* Houpis, J.L.J., 15:2309
Benet, Ph., *See* Moore, E.F., 15:4107
Benford, G., *See* Tzach, D., 15:4363
Bengtson, R.D., *See* Lin, H., 15:4379
Benignus, V.A., Effects of atmospheric mix and toxic fumes on military performance, 15:3777 (R;US)
Human-health studies of carbon monoxide (CO) under conditions of military weapons systems crewman exposures. Protocol 1: Formation of cohb. Final report, September 1982-March 1985, 15:3755 (R;US)
Bennett, B.L., *See* Cooke, D.W., 15:2921
Bennett, D.P., Two-point correlation function of cosmic-string loops, 15:4054 (J;US)
Bennett, G.L., *See* Flood, D.J., 15:2296
Bennett, L.F., *See* Haworth, M.D., 15:3275
Bennett, L.H., Magnetic viscosity in Ni/Cu compositionally-modulated alloys, 15:2812 (R;US)
Bennett, M.S., *See* Ayra, R.R., 15:2305
See Carlson, D.E., 15:2303
See Catalano, A.W., 15:2304
Beno, M.A., The possible occurrence of multi-phase behavior in the high T_c superconductor $YBa_2Cu_3O_x$, 15:4249 (R;US)
See Porter, L.C., 15:4252
Benson, S.M., *See* Mensch, A., 15:2105
Bentley, C.R., *See* Bohling, G.C., 15:3560
Benvenuti, A., The digital data acquisition chain and the cosmic ray trigger system for the SLD Warm Iron Calorimeter, 15:3357 (R;US)
Benz, F.J., *See* Joyce, J.P., 15:2650, 15:2651
Beraun, R., *See* Argueello, J.G., 15:2235
Berdov, B.A., Conservative and surgical treatment of rectovaginal fistulas induced by irradiation, 15:3737 (RA;SU;In Russian)
Contemporary possibilities of combined treatment of rectum cancer, 15:3636 (RA;SU;In Russian)
Berezhnov, I.P., Efficiency of larynx cancer radiotherapy in dose multifractionating, 15:3637 (RA;SU;In Russian)
See Ovchinnikov, V.A., 15:3739
Berg, D.E., VAWT dynamic stall models revisited, 15:2394 (BA;US)
Berg, D.E. Klimas, P.C., Proceedings of the eighth ASME wind energy symposium, 15:2387 (B;US)
Bergemann, M., *See* Fluegge, G., 15:3566
Berger, E.L., B production in hadron collisions: Theory, 15:3973 (R;US)
Berger, J., *See* Baumann, W., 15:3293, 15:3294, 15:3345, 15:3889, 15:3890
Berger, M.S., Surface tension of strange-quark matter in the early Universe, 15:3880 (J;US)
Berger, S.D., *See* Pennycook, S.J., 15:2997
Berggren, M.H., *See* Boysen, J.E., 15:2017
Bergholm, A., Petroleum fuels. Development of quality from 1980 and on, 15:2135 (R;SE;In Swedish)
Bergshoeff, E., New spacetime superalgebras and their Kac-Moody extension, 15:4266 (R;XA)
Bergtold, D.S., Background levels of DNA damage, 15:3724 (RA;DE)
Berkner, K.H., *See* Bernstein, E.M., 15:3926
Berkowicz, R., Calculation of air pollution dispersion over a complex terrain with special emphasis on dimensioning of chimney stacks, 15:3420 (R;DK;In Danish)
Berkowitz, J., *See* Ruscic, B., 15:2952, 15:3927
Berlow, J.R., Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:2772 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:2773 (R;US)
Treatment technology background document, 15:2764 (R;US)
Berman, C.H., Enhanced flame stability and soot radiation using electric fields. Final report, July 1986-January 1989, 15:3114 (R;US)
Berman, D., *See* Kahn, E.P., 15:2635
Berman, L.E., Angular distribution of the photoelectron yield excited by two coherently coupled photon beams, 15:4239 (J;US)
Bernabei, S., Lower hybrid current drive activity at Princeton, 15:4337 (RA;JP)
Bernard, J.M., Coupled multiline c-w (continuous-wave) HF (hydrogen fluoride) lasers: Experimental performance. Technical report, 15:3149 (R;US)
Bernard, M.J. III, Supporting independent inventors, 15:2605 (R;US)
Bernhard, W.A., Free radicals formed by electron gain in oligomers of DNA, 15:3702 (RA;DE)
Bernstein, E.M., Test of predicted $\Delta n \geq 1$ *L*-shell dielectronic-recombination cross sections, 15:3926 (J;US)
Berry, L., *See* Goldman, C.A., 15:2624
Berry, R.S., *See* Jellinek, J., 15:4297
Berry, W.B., Low temperature diffusivity for aluminum and silver in amorphous silicon, 15:2310 (BA;US)
See Mrig, L.C., 15:2312
Berson, A.E., Cloning and characterization of the recA gene of Aquaspirillum magnetotacticum, 15:3610 (R;US)
Berta, V.T., *See* Modro, S.M., 15:2551
Bertault, D., *See* Stolterfoht, N., 15:4071
Berthoud, T., Optogalvanic spectroscopy in flames, 15:3040 (R;FR;In French)
Bertram, H., *See* Hagen, U., 15:3706
Bertrand, C., Silicon calorimetry for the SSC[Superconducting Supercollider], 15:3331 (R;US)
Bertsch, G., Temporal development of the plasma phase transition, 15:4242 (J;US)
Bertus, K.M., *See* Chase, K.L., 15:2114

Beskid, N.J., *See* Devgun, J.S., 15:2180
Bettarello, A., *See* Ginabreda, M.G.P., 15:3104
See Ginabreda, P., 15:3622
Beuhler, R.J., Cluster-impact fusion, 15:4240 (J;US)
Bezerra, J.H.B., *See* Araujo, R.M.S. de, 15:3054
Bezilla, M., Multi-mechanistic approach to the reservoir analysis of tight blanket sands, 15:2141 (BA;US)
Bhadra, D.K., *See* Porter, G.D., 15:4331
Bhadra, R., *See* Okamoto, P.R., 15:2861
Bharadwaj, S.R., *See* Chattopadhyay, G., 15:2811
Bhasin, K.B., *See* Miranda, F.A., 15:2928
Bhatia, K., *See* Behar, M., 15:4227
Bhattacharyya, B., Generation of axial and lateral magnetic fields in laser produced plasmas, 15:4315 (R;XA)
Bi, H., *See* Morsi, B.I., 15:2015
Bickers, N.E., *See* Schlesinger, Z., 15:2958
Bickerstaff, D.D., Computerized Adaptive Testing, 15:4532 (R;US)
Bieg, K.W., *See* Ruiz, C.L., 15:3311
Biersack, J.P., *See* Behar, M., 15:4227
Bigelow, T.S., *See* Harris, J.H., 15:4372
Bilello, J.C., *See* Schmitz, H.A., 15:2875
Billone, M.C., Advancements in the behavioral modeling of fuel elements and related structures, 15:2504 (R;US)
Bingham, C.E., Measurement uncertainty of adsorption testing of desiccant materials, 15:2341 (BA;US)
See Pesaran, A.A., 15:2340
Binkowski, F.S., *See* Patrinos, A.A.N., 15:3472
Binon, F.G., *See* Alde, D., 15:3969
Bird, I.G., *See* Alberich, T., 15:3956
Birdsell, K.H., Preliminary integrated calculation of radionuclide cation and anion transport at Yucca Mountain using a geochemical model, 15:2204 (R;US)
Birmingham, B.S., *See* Loree, T.R., 15:3179
Birmingham, D., Geometry and quantization of topological gauge theories, 15:4041 (R;XA)
Birnbaum, H.K., *See* Rozenak, P., 15:2870
Birrer, S.A., *See* Gross, J.M., 15:2247
Birtcher, R.C., Temperature dependence of Kr precipitation in Ni, 15:2864 (BA;US)
Biscaye, P.E., Transport and transfer rates in the waters of the continental shelf and slope: SEEP: Triennial report, 1 May 1987–30 April 1990, 15:3817 (R;US)
Bisello, D., *See* Benvenuti, A., 15:3357
Bitter, M., *See* Park, H.K., 15:4350
Biunno, N., *See* Singh, R.K., 15:2943
Bixler, N.E., *See* Eaton, R.R., 15:2234
Bjarne, E., *See* Bjoerk, C., 15:2641
Bjoerck, A., Airfoil design for horizontal axis wind turbines, 15:2377 (RA;DK)
Bjoerk, C., Industrial load management at Vaargaarda, 15:2641 (R;SE;In Swedish)
Blachere, J., *See* Morsi, B.I., 15:2015
Blackman, H., *See* Kaplan, B., 15:4514
Blackman, H.S., *See* Hahn, H.A., 15:2480
Blair, M.F., *See* Dring, R.P., 15:3199
Blair, S.C., *See* Heuze, F.E., 15:2148
Blaizot, J.P., Theoretical aspect of J/PSI production in nucleus-nucleus collisions, 15:3976 (R;FR)
Blakeman, E.D., *See* Mihalczo, J.T., 15:3125
Blakers, A.W., 22.8% efficient silicon solar cell, 15:2318 (J;US)
Blanchard, J.P., *See* Cooke, P.I.H., 15:4469
See Hasan, M.Z., 15:4468
Blanchard, R.L., *See* Lloyd, V.D., 15:3571
See Semler, M.O., 15:3568
Blanchat, T.K., *See* Bagwell, T.G., 15:3209
Blanis, D., *See* Shaw, N.M., 15:3970
Blankenbecler, R., Pair production from photon-pulse collisions, 15:4016 (J;US)
Blankleider, B., *See* Nozawa, S., 15:3977
Blatt, K., *See* Becker, K., 15:4097, 15:4136
Blau, M., *See* Birmingham, D., 15:4041
Blau, S.K., Bubble dynamics and spontaneous compactification, 15:3879 (J;US)
Blaylocck,, *See* Joyce, J.P., 15:2650
Blaylock,, *See* Joyce, J.P., 15:2651
Bleier, A., Experimental analysis of the behavior of iodine in the event of hypothetical accidents - iodine partition coefficients (follow-on project). Final report, 15:2555 (R;DE;In German)
Blevins, R.P., 1988 survey of residential-sector demand-side management programs: Final report, 15:2645 (R;US)
Bliem, C.J., Aspects of the Kalina technology applied to geothermal power production, 15:2354 (R;US)
Blinder, S.M., Generalized relations among *N*-dimensional Coulomb Green's functions using fractional derivatives, 15:4294 (J;US)
Blinn, M.B., Advanced gasifier-desulfurizer process development for SNG (substitute natural gas) application. Final report, August 1987-December 1988, 15:2047 (R;US)
Bloch, J.M., Morphology of Langmuir-Blodgett multilayers: A near-total external fluorescence and reflectivity study, 15:3030 (J;US)
Blomquist, J.A., *See* Peraino, C., 15:3599
Blomqvist, J., *See* McNeill, J.H., 15:4101
Bloom, I., Effect of heat treatment time and temperature of the properties of $YBa_2Cu_3O_{7-x}$, 15:2945 (J;US)
Bloss, W.L., *See* Krantz, R.J., 15:3360
Bloyd, C.N., *See* Streets, D.G., 15:3408
Bluemke, D., *See* Hesse, D., 15:2103
Blum, L.K., *See* Gunnison, D., 15:3543
Blum, M., The Heidelberg heavy ion postaccelerator, 15:3289 (RA;DE;In German)
Board, M., FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1, 15:2215 (R;US)
FLAC (Fast Lagrangian Analysis of Continua), Version 2.20: User's manual, 15:2216 (R;US)
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Verification, example and benchmark problems: Volume 3, 15:2217 (R;US)
UDEC (Universal Distinct Element Code) version ICG1.5: User's manual: Volume 2, 15:3816 (R;US)
Boatner, L.A., *See* Boldu O., J.L., 15:3023
See Rankin, J., 15:2941
Bochove, E.J., *See* Milonni, P.W., 15:3929
Bodek, A., *See* Shaw, N.M., 15:3970
Boden, T.A., *See* Schuhardt, S.L., 15:3396
Bodily, D.M., *See* Hucka, V.J., 15:2083
Bodnarczuk, M., New directions for QA in basic research: The Fermilab/DOE-CH experience, 15:4491 (R;US)
Bodvarsson, G.S., *See* Aunzo, Z., 15:2355, 15:2356
Bodyulkov, A., Composite scalar mesons in QCD, 15:3988 (R;XA)
Boeer, K.W., Loss minimization through recombination center identification, 15:2301 (R;US)
Boeglin, W., *See* Baur, G., 15:4077
Boekema, C., *See* Cooke, D.W., 15:4256
Boenig, H.J., Transportation of a 451 ton generator stator and a 234 ton generator rotor from Hartsville, TN, to Los Alamos, NM, 15:4434 (R;US)
See Reass, W.A., 15:4436
Boercker, D.B., *See* Hrubesh, L.W., 15:2987
Bogo, V., Radiation quality and rat motor performance, 15:3691 (R;US)
Bohac, D.L., *See* Dudney, C.S., 15:2693
Bohigas, O., Aspects of chaos in nuclear physics, 15:4140 (RA;DE)
Bohling, G.C., Use of ground-penetrating radar to define recharge areas in the Central Sand Plain. Technical completion report, 15:3560 (R;US)
Bohn, M.S., Drop ejection in molten-salt direct absorption central receivers, 15:2324 (BA;US)
Heat transfer and pressure drop measurements in an air/molten salt direct-contact heat exchanger, 15:2337 (BA;US)
Bohnen, K.P., *See* Voigtlander, B., 15:2895
Bohnet, A., Microscopic description of heavy ion reactions in the Fermi energy domain, 15:4149 (RA;DE)
Bojko, A.V., Evaluation of radiocurability of small cell pulmonary carcinoma according to full value of local control during radiotherapy in clinic, 15:3638 (RA;SU;In Russian)
Boldu O., J.L., Electron paramagnetic resonance investigations of divalent cobalt in single crystals of perovskite ($CaTiO_3$), 15:3023 (J;US)

Bolet, B., Resource saving cassette building system for low energy houses, 15:2674 (R;DK;In Danish)
Boley, M.S., *See* Shi, D., 15:2947
Boll Illerup, J., Measurements of gas concentrations and temperature in a boiler room, 15:2428 (R;DK;In Danish)
Bolton, H. Jr., *See* Cataldo, D.A., 15:3463
Bond, J.R., *See* Salopek, D.S., 15:3878
Bond, R.D., Ultrasonic and immersion cleaning: a comparison using aqueous and fluorocarbon solvents, 15:2176 (R;GB)
Bonne, A., *See* Marivoet, J., 15:2196
Bonzon, C.J., *See* McElroy, D.L., 15:2186
Boonekamp, P.G.M., Cogeneration- and Total Energy potentials at an alternative natural gas price policy and environmental policy in the Dutch National Energy Outlook scenarios, 15:2619 (B;NL;In (In Dutch))
Boorstein, R.J., *See* Teebor, G.W., 15:3735
Boose, D., Variance in the fluctuating cross-section, 15:4145 (RA;DE)
Booth, E.C., *See* Whitehouse, D.A., 15:3971
Borchi, E., *See* Bertrand, C., 15:3331
Bordes, J., Half-string oscillator approach to string field theory, 15:4045 (R;GB)
Borejsho, D.E., Method of synchronous determination of linear blood flow time in arteries and veins separately, 15:3634 (RA;SU;In Russian)
Borg, A., *See* Dessau, D.S., 15:2956
See Shen, Z., 15:2960
Borghi, V.C., Rapid method for purification of radioiodinated glucagon, 15:3623 (R;BR;In Portuguese)
Rapid purification of radiodinated glucagon with Sep-Pak^{R} reversed phase cartridges, 15:3621 (R;BR)
See Ginabreda, M.G.P., 15:3104
See Ginabreda, P., 15:3622
Boring, A.M., *See* Norman, M.R., 15:4248
Bortignon, P.F., *See* Viesti, G., 15:4091
Bose, A., *See* German, R.M., 15:2808
Boshoven, J.K., Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)
Bothe, E., Rate and yield of OH-induced strand break formation of polynucleotides and DNA, 15:3728 (RA;DE)
Bott, J.F., Dissociation and vibrational relaxation of XeF by various collision partners, 15:3146 (R;US)
Bottcher, C., *See* Rhoades-Brown, M.J., 15:4176
Bottcher, J.H., Fuel/sodium reaction product formation in breached mixed-oxide fuel, 15:2463 (J;US)
Botto, R.E., Isotope labeling investigations in simulated coalification: A view of geological metamorphism, 15:2052 (R;US)
See Carrado, K.A., 15:2992
Boucher, T.J., Scale model test results for an inverted U-tube steam generator with comparisons to heat transfer correlations, 15:2518 (R;US)
Bouchet, F.R., *See* Bennett, D.P., 15:4054
Boulouchos, K., *See* Bardsley, M.E.A., 15:2789
Bourcier, W.L., A kinetic model for dissolution of borosilicate glass, 15:2240 (R;US)
See Worlery, T.J., 15:2238
Bourgade, J.L., *See* Naccach, D., 15:4369
Bowen, T.C., *See* Butler, W.E., 15:2122
Bowker, P., *See* Kerfoot, W.B., 15:3573
Bowman, J.M., *See* Gazdy, B., 15:3100
Bowsher, B.R., New estimates for the thermodynamic functions of molecular boric acid, 15:3069 (R;GB)
See Ogden, J.S., 15:3068
Box, H.C., Studies of radiation damage using DNA oligomers, 15:3723 (RA;DE)
Boyanovsky, D., Zamolodchikov's *c*-theorem reexamined, 15:4057 (J;US)
Boyer, P.D., *See* Du, Z., 15:3605
Boyle, M.E., Eye/sensor protection against laser irradiation: Organic nonlinear optical materials. Final report, April-December 1988, 15:3798 (R;US)
Boysen, J.E., Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the fourth quarterly, July 1, 1989–September 30, 1989, 15:2017 (R;US)
Bozeman, E.L. Jr., Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Alewife and blueback herring, 15:3536 (R;US)
Braams, B.J., *See* Rensink, M.E., 15:4450
Braaten, N.A., Photoemission study of formation and oxidation of a cerium-copper interface, 15:2891 (J;US)
Bracco, F.V, *See* Bardsley, M.E.A., 15:2789
Bracht, K., Measures for reduction of severe accident consequences: Comprehensive evaluation of the results sponsored by the BMI, 15:2495 (R;DE;In German)
Bradbury, S.P., Structural properties for determining mechanisms of toxic action, 15:3778 (R;US)
Bradley, D.K., *See* Marshall, F.J., 15:4484
Bradshaw, W.M., Removal of acidic gases from incinerator flue gas in a fluidized bed scrubber, 15:2075 (B;US)
Brady, A.L., *See* Waters, M.D., 15:3766, 15:3768, 15:3775
Braga, C.V.M., Thermohydraulic analysis of smooth and finned annular ducts, 15:3189 (R;BR;In Portuguese)
Brahm, D.E., Low-energy lepton violation from supersymmetric flipped SU(5), 15:4031 (J;US)
Branagan, P.T., *See* Warpinski, N.R., 15:2117
Brand, H.-N., *See* Caldas, L.V.E., 15:3335
Brand, R.A., Measuring heat flows in collective heating systems. Illusion or reality, 15:2702 (R;NL;In (In Dutch))
Measuring heat flows in collective heating systems. Appendices and figures, 15:2703 (R;NL;In (In Dutch))
Brandao Filho, D., Thorium re-improvement of residues from thorium purification plants, 15:2169 (R;BR;In Portuguese)
Brandao Mello, C.E., *See* Valverde, N.J., 15:3698
Brandstaedter, M., *See* Ginsberg, A.P., 15:2558
Brannon, J.M., *See* Gunnison, D., 15:3543
Brase, J., *See* Azevedo, S.G., 15:4530
Bratten, W.A., Business communications, 15:4536 (R;US)
Brau, J.E., *See* Bertrand, C., 15:3331
Bray, M.A., *See* Sebo, D.E., 15:2482
Breding, D.R., *See* Hardin, T.L., 15:3815
Breitbach, G., High energetic photons from heavy ion collisions, 15:4105 (RA;DE;In German)
See Hennrich, H.J., 15:4095
Breitenbach, M., *See* Burkert, E., 15:3347
Brener, R., *See* Shechter, H., 15:2881
Brenner, D.S., *See* Zhang, J.-Y., 15:4125
Brenner, S., *See* Muench, H.S., 15:3474
Brereton, S.J., Economic comparison of fusion fuel cycles, 15:4462 (BA;US)
Model for calculating room air and surface tritium concentrations, 15:3480 (R;GB)
Breskin, A., Development of an electron spectrometer for the HELIOS heavy ion experiment at CERN, 15:3346 (RA;DE;In German)
Bretscher, M.M., Interpretation of gamma-scanning data from the ORR demonstration elements, 15:2489 (R;US)
Bretz, N., *See* Park, H.K., 15:4350
Brewer, J.A., *See* Carlson, D.E., 15:2303
Brewer, R.F., *See* Williams, L.E., 15:3445
Bricman, C., *See* Alde, D., 15:3969
Briere, R.A., Possible test of *CPT* invariance in neutral-kaon regeneration, 15:4028 (J;US)
Briesmeister, J.F., *See* Forster, R.A., 15:3378
Briggs, R.J., Applications of induction linacs to free-electron lasers and particle beams, 15:3313 (J;US)
Brigham, W.E., *See* Ogbe, D.O., 15:2116
Briley, W.R., *See* Buggeln, R.C., 15:3200
Brittain, J.O., *See* Lei, J.F., 15:3368
Britz, W., *See* Sciacca, F., 15:2543
Brix, P., *See* Blum, M., 15:3289
Brockman, H.E., *See* DeMarini, D.M., 15:3612
Brodsky, S.J., *See* Eller, T., 15:3996
Bromborsky, A., Intense microwave radiation from a repetitive backward-wave oscillator driven by a relativistic electron beam, 15:4182 (J;US)
Brooks, E.D. III, PCP [Parallel C Preprocessor]: A parallel extension of C that is 99% fat free: Revision 1, 15:4531 (R;US)
Symbolic implicit Monte Carlo, 15:4181 (J;US)

Brooks, R., The spectrum of topological quantum field theories on N-manifolds, 15:4050 (J;NL)
Brovold, S., *See* Ohmann, L.F., 15:3455
Browder, T.E., Recent results on weak decays of charmed mesons from the Mark III experiment, 15:3967 (R;US)
Brower, K.R., *See* Morrow, N.R., 15:2146
Brower, R.W., *See* Golden, D.W., 15:2520
Brown, C.B., *See* Larson, T.K., 15:4515
Brown, C.M., Measurement of relative electron-impact-excitation cross sections for Fe^{24+}, 15:3925 (J;US)
Brown, C.R., *See* Whitaker, R.B., 15:3380
Brown, D.R., *See* Cooke, D.W., 15:2921
Brown, G.E., *See* Bertsch, G., 15:4242
Brown, I.G., Broad-beam multi-ampere metal ion source, 15:3301 (R;US)
See Galvin, J.E., 15:3302
See MacGill, R.A., 15:3303
See Rubin, M., 15:2951
See Shiraishi, Hiroshi, 15:3891
Brown, J.C., *See* Cowley, P.J., 15:2598
Brown, K.J., Process integration initiative. A review of the process integration activities funded under the Energy Efficiency R and D programme, 15:2732 (R;GB)
Brown, M.D., *See* Butner, D.N., 15:4358
Brown, R.H., *See* Joyce, J.P., 15:2650, 15:2651
Brown, R.M., *See* Patrinos, A.A.N., 15:3472
Brown, T.M., An asteroseismology explorer, 15:3874 (BA;US)
Brown, W.T., ANEOS [analytic equation of state package] models for shock compression of saturated limestone: Applications to ground shock calculations, 15:3081 (R;US)
Brownlee, J.A., *See* Powers, T.J., 15:3256
Broyde, S., Interactions of carcinogens with DNA [deoxyribonucleic acid]: Final progress report, July 1, 1987–July 31, 1989, 15:3760 (R;US)
Brucker, A., Coulomb breakup of ^{7}Li, 15:4109 (RA;DE;In German)
Bruckner, J.V., *See* Dallas, C.E., 15:3757
Brueckner, W., Measurement of proton-antiproton cross sections at low momenta, 15:3955 (RA;DE;In German)
See Alberich, T., 15:3956
Bruening, D., *See* Bach, F.W., 15:2532
Bruggink, D., *See* Olson, R.E., 15:4477
Bruins, R.J.F., Analytical methods necessary to implement risk-based criteria for chemicals in municipal sludge, 15:2775 (R;US)
See Stara, J.F., 15:3779
Brunet, H., Stress corrosion cracking of an uranium-6 weight per cent niobium in gaseous oxygen, nitrogen and hydrogen, 15:2814 (R;FR;In French)
Bruton, C.J., *See* Worlery, T.J., 15:2238
Bruzzi, M., *See* Bertrand, C., 15:3331
Bryant, R.S., *See* Chase, K.L., 15:2114
Bryder, K.L., District heating connections with high consumption, 15:2761 (R;DK;In Danish)
Bryn, I., Simulation of energy consumption by taking thermal comfort into account, 15:2701 (R;NO)
Buchal, C.J, *See* Appleton, B.R., 15:2964
Buchanan, A.C. III, [Coal science]: Foreign trip report, October 20, 1989–October 31, 1989, 15:2065 (R;US)
Buchholz, P., *See* Auerbach, L.B., 15:3951
Buchleiter, G.W., *See* Chou, F.N.F., 15:2724
Buck, J.W., Use of the Multimedia Environmental Pollutant Assessment System (MEPAS) for large- and small-scale applications, 15:2229 (R;US)
Buckley, B.B., ISIS: An Interactive System for Instruction and Sampling, 15:3483 (R;US)
Buckley, J.S., *See* Morrow, N.R., 15:2146
Budd, H., *See* Shaw, N.M., 15:3970
Buden, D., *See* Mims, J., 15:2494
Budnick, J.I., *See* Tan, Z., 15:3028
Budny, R., *See* Park, H.K., 15:4350
Buell, J. C., *See* Ho, C. M., 15:3204
Buerger, R., Changes in ground vegetation of forest ecosystems in the middle and southern regions of the Black Forest, 15:3763 (R;DE;In German)
Buerkmann, K., *See* Sulzer, G., 15:4228
Buffington, R.J., *See* Macha, J.M., 15:3139
Bufton, J.L., *See* Ramos-Izquierdo, L., 15:3164
Bugel, L., *See* Serfass, J., 15:2258
Bugg, W.M., *See* Bertrand, C., 15:3331
Buggeln, R.C., Two- and three-dimensional turbine blade row flow field simulations, 15:3200 (RA;US)
Buki, K.G., *See* Sastry, S.S., 15:3597
Bulanov, S.V., Investigation of the non linear Buneman instability in a multi ion plasma, 15:4313 (R;XA)
Bulian, N., Nuclear physics electronics, 15:3342 (RA;DE;In German)
Buna, T., *See* Anderson, J., 15:2323
Burgoine, D., Siphon penstock installations at hydroelectric projects: A survey of design, construction and operating experience, 15:2277 (R;US)
Burke, A.F, Evaluation of state-of-charge indicator approaches for EVs, 15:2585 (B;US)
Burke, A.F., Characterization of electric vehicle velocity and power profiles using road test data, 15:2792 (R;US)
Burkert, E., Gallium solar neutrino experiment (project 'GALLEX'), 15:3347 (RA;DE;In German)
Burkhalter, H.E., Analysis of physical training of security inspectors at Los Alamos National Laboratory: A preliminary report, 15:4487 (R;US)
Burley, B.L., DIII-D F-coil chopper selection, control and fault recognition system, 15:4413 (R;US)
Burnham, A.K., Energy and Technology Review, October 1989, 15:4355 (R;US)
Burns, F.J., Cancer risk for radon exposure in a polluted environment: Progress report, March 1, 1989–February 28, 1990, 15:3413 (R;US)
Lung cancer risk from inhalation of radon and other pollutants in rats: Comprehensive progress report, March 1, 1987–February 28, 1990, 15:3412 (R;US)
Burrell, K.H. and others, *See* Porter, G.D., 15:4331
Burriel, R., *See* Westrum, E.F. Jr., 15:3021
Burrows, P.N., *See* Benvenuti, A., 15:3357
Buschbom, R.L., *See* Wehner, A.P., 15:3793
Buschert, J.R., Time resolved x-ray diffraction study of laser annealing in silicon at grazing incidence, 15:3017 (J;US)
Bussel, G.J.W. van, Aerofoil design and testing, 15:2370 (RA;DK)
Butler, N., *See* Cooper, C.A., 15:3123
Butler, W.E., US Marine 3rd Tank Battalion lubrication evaluation under hot ambient temperatures at Twenty-Nine Palms, California. Interim report, April-September 1988, 15:2122 (R;US)
Butner, D.N., The MTX [Microwave Tokamak Experiment] data acquisition system, 15:4358 (R;US)
Butsch, R., *See* Becker, K., 15:4097, 15:4136
See Reich, H., 15:3290
Butterfield, C.P., Aerodynamic pressure and flow-visualization measurement from a rotating wind turbine blade, 15:2402 (BA;US)
See Reda, D.C., 15:2403
Byrer, C.W., *See* Komar, C.A., 15:2142
Byrns, R.A., Review of SC/RF refrigeration systems, 15:3129 (R;US)
Bytnerowicz, A., Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)

C

Cadwallader, L.C., Critical safety function guidelines for experimental fusion facilities, 15:4405 (R;US)
Cadwell, L.L., *See* Eberhardt, L.E., 15:2232
Cahn, J.H., Linear nonadiabatic pulsations of homogeneous ZAMS stars, 15:3871 (BA;US)
Cain, W.C., *See* Kominsky, J.R., 15:3437
See Powers, T.J., 15:3256
Caires, A.C.F., Study for the determination of samarium, europium,terbium, dysprosium and yttrium in gadolinium oxide matrix by means of atomic absorption spectrophotometry using a graphite furnace, 15:3058 (R;BR;In Portuguese)
Cairns, E.J., Center for Building Science of the Applied Science Division annual report, FY 1988, 15:2689 (R;US)
Calcaterra, A., *See* Benvenuti, A., 15:3357
Calcote, H.F., *See* Berman, C.H., 15:3114

Caldas, L.V.E., Performance of special extremity dosemeters of BeO in fields of x and gamma radiation, 15:3335 (R;BR;In Portuguese)
See Campos, L.L., 15:3336
Caldi, D.G., *See* Haller, K., 15:3942
Caldwell, J.T., *See* Schultz, F.J., 15:2181
Calise, J.A., *See* Schlesinger, Z., 15:2958
Calicott, T.A., *See* Arakawa, E.T., 15:2830
See Perera, R.C.C., 15:3019
Callen, J., *See* Moses, G.A., 15:4461
Calori, F., *See* Islam, M.M., 15:2617
Campbell, A.M., Effect of twins on critical currents of high T_c superconductors. Interim report No 4, 15:3120 (R;GB)
Campbell, D.K., Strongly correlated quasi-one-dimensional bands: Ground states, optical absorption, and phonons, 15:4231 (R;US)
Campbell, G.L., DIII-D cryogenic control system upgrade, 15:4411 (R;US)
Campbell, K., *See* Birdsell, K.H., 15:2204
Campbell, R., *See* Hoffman, M.A., 15:4444
Campbell, R.B., Microwave superheaters for fusion, 15:4464 (BA;US)
Campos, L.L., Conection factors for clinical dosemeters used in dosimetry of large fields radiation, 15:3336 (R;BR;In Portuguese)
Canadell, E., *See* Whangbo, Myung-Hwan, 15:4251
Canavan, G.H., Defensive technologies for Europe, 15:3391 (BA;US)
Cannell, A.L., *See* Smith, E.O., 15:2070, 15:2071
Cannon, M.W., Battlefield nuclear weapons and tactical gridlock in Europe, 15:3387 (R;US)
Cannon, S.V., *See* Teebor, G.W., 15:3735
Cannon, W.C., *See* Wehner, A.P., 15:3793
Caplan, P.E., Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey, 15:3456 (R;US)
Capone, D.W. II, *See* Beno, M.A., 15:4249
Capone, D.W.,II, *See* Bloom, I., 15:2945
Capone, R.L., Development of the advanced utility simulation model. Report for May 1985-September 1988, 15:2430 (R;US)
Carey, T.A., *See* Oothoudt, M.A., 15:3297
Carioli, S.M., Hydromagnetic space-time, 15:4284 (RA;DE;In German)
Stochastic acceleration of relativistic particles, 15:3826 (RA;DE;In German)
Cariss, C.S., *See* Porter, L.C., 15:4252
Carille, D.W., *See* Eberhardt, L.E., 15:2232
Carlisle, N., Field survey of 259 active solar DHW systems, 15:2339 (BA;US)
Carlitz, R.D., The role of the axial anomaly in determining spin-dependent parton distributions, 15:3972 (R;US)
Carlson, D.E., Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 3 final subcontract report, February 1, 1986–January 31, 1987, 15:2303 (R;US)
See Catalano, A.W., 15:2304
Carlson, K.D., *See* Porter, L.C., 15:4252
Carlson, L.W., Continuous cryopump with a method for removal of solidified gases, 15:3141 (P;US)
Carlson, N.M., *See* Garcia, G.V., 15:2834
Carlsten, B.E., *See* Goldstein, J.C., 15:3158, 15:3298
Carman, H.S. Jr., High-order multiphoton ionization photoelectron spectroscopy of NO, 15:3903 (J;US)
Carmo, E.G.D. do., *See* Franca, L.P., 15:3194
Carnahan, B., United States policy on negative security assurances: A reassessment, 15:2803 (R;US)
Carne, T.G., Model validation of the Sandia 34-meter test bed turbine using substructured modal-testing, 15:2408 (BA;US)
Carneiro, M.B., *See* Knoefel, M.J., 15:2248
Carnes, B.A., *See* Peraino, C., 15:3599
Carpenter, G., *See* Wong, I., 15:3807
Carpenter, J.M., *See* Jorgensen, J.D., 15:3358
Carpenter, S., Radiobiology of ultrasoft X rays. IV. Flat and round-shaped hamster cells (CHO-10B, HS-23), 15:3754 (J;US)
Carpenter, S.H., Investigation of fracture toughness and fracture mechanisms using acoustic emission measurements: Progress report, 1 March 1989–28 February 1990, 15:2829 (R;US)
Carrado, K.A., Structural studies of pillared clays and modified pillared clays, 15:2992 (BA;US)
See Botto, R.E., 15:2052
Carrasquillo, J.A., *See* Larson, S.M., 15:3682
Carreau, M., Momentum-space representation in curved space, 15:4056 (J;US)
Carrera, R., *See* Montalvo, E., 15:4457
Carreras, B.A., *See* Harris, J.H., 15:4372
Carrier, R.F., *See* Foley, R.D., 15:3509, 15:3510
Carroll, A., Overview of recent focussing horns for the BNL neutrino program, 15:3269 (BA;US)
Carter, R.J., Human factors survey of advanced instrumentation and controls, 15:2437 (R;US)
Carter, W., *See* Cukauskas, E., 15:3233
Cartwright, S.L., *See* Benvenuti, A., 15:3357
Caruthers, L.E., A plan for administrative computing at ANL, FY 1990 through FY 1992, 15:4535 (R;US)
Carvalho, F.M.S. de, Study on behaviour of voltametric wave of UO_2^{2+} in an electrode of mercury pendent drop and H_2SO_4 as suport electrolyte, 15:3051 (R;BR;In Portuguese)
Cary, J.R., *See* Gandy, R.F., 15:4399
Casada, D.A., Aging assessment of auxiliary feedwater systems, 15:2511 (R;US)
Caskey, C.T., Mapping and ordered cloning of the human X chromosome: Progress report, November 1988–October 1989, 15:3603 (R;US)
Casper, T.A., *See* Butner, D.N., 15:4358
See Hooper, E.B., 15:4352
Caspi, S., *See* Peters, C., 15:3300
Cassady, M., Development of short-term tests for evaluating plastic gas-piping materials. Annual report, January-December 1984, 15:2150 (R;US)
Cassing, W., *See* Bellm, D., 15:4086
Casten, R.F., Saturation effects in gamma-band energies, 15:4172 (J;US)
See Zhang, J.-Y., 15:4125
Castleman, A.W. Jr., *See* Chen, Z.Y., 15:3097
Castro, A., *See* Benvenuti, A., 15:3357
Catalano, A.W., Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 1, Annual subcontract report, February 1, 1987–January 31, 1988, 15:2304 (R;US)
See Carlson, D.E., 15:2303
Cataldo, D.A., Evaluate and characterize mechanisms controlling transport, fate, and effects of army smokes in the aerosol wind tunnel: Transport, transformations, fate, and terrestrial ecological effects of hexachloroethane obscurant smokes: Final report, 15:3463 (R;US)
Cathat, C.L., Second class currents and the β-particle asymmetry at the decay of oriented ^{24m}Na nuclei, 15:4158 (R;SU)
Cathcart, J.V., Chromium modified nickel-iron aluminide useful in sulfur bearing environments, 15:2896 (P;US)
Cather, M., *See* Morrow, N.R., 15:2146
Caton, H., Radiation-transport calculations of a simple structure using the vehicle code system with 69-group cross sections and the Monte Carlo neutron and photon code. Final report, 15:4178 (R;US)
Catravas, G.N., *See* Kalinich, J.F., 15:3690
Catto, P.J., *See* Aamodt, R.E., 15:4307
Caughman, J.B.O. II, An assessment of the lifetime of Faraday shield elements, 15:4392 (R;US)
Ceder, G., *See* de Fontaine, D., 15:2948
Cederwall, R.T., *See* Shinn, J.H., 15:3468
Celotta, R.J., *See* McClelland, J.J., 15:3909
Ceplecha, Z., *See* Kiko, J., 15:4151
Cerda, H., *See* Rosander, K., 15:3745
Cernicek, M., The degradation of natural resources in the Soviet Union, 15:3593 (R;US)
Cha, C.Y., *See* Boysen, J.E., 15:2017
Chabal, Y.J., *See* Williams, G.P., 15:3283
Chadwick, M.B., Calculation of the production cross sections of high-spin isomeric states in hafnium, 15:4429 (R;US)
Chaix, P., Dirac-Fock calculations in multi-harmonic-oscillator basis, 15:4507 (R;FR;In French)

Chakmakjian, S.H., *See* Koch, K., 15:3153
Chakoumakos, B.C., *See* Sonder, E., 15:2959
Chalkias, S., Geological interpretation of lead isotope ratios in ores from the Aegaean, 15:3493 (RA;DE;In German)
Chambers, R.R. Jr., [Coal structure and basic reactions]: Foreign trip report, October 20, 1989–October 28, 1989, 15:2064 (R;US)
Chambre, P.L., *See* Hwang, Y., 15:2206, 15:2207, 15:2212
See Kim, C.-L., 15:2205
See Light, W.B., 15:2209
See Zwahlen, E.D., 15:2211
Chamis, C. C., Computational simulation of high temperature metal matrix composites cyclic behavior, 15:2976 (R;US)
Chamis, C.C., Probabilistic structural analysis methods of hot engine structures, 15:3248 (R;US)
See Lackney, J., 15:3242
Champagne, A.E., *See* Wang, T.F., 15:4082
Chan Hongmo, Towards a 'pointless' generalisation of Yang-Mills theory, 15:4046 (R;GB)
See Bordes, J., 15:4045
Chan, B.C., *See* Van Tuyle, G.J., 15:2496, 15:2546
Chan, C.F., *See* Kwan, J.W., 15:3305
Chan, C.T., *See* Takeuchi, N., 15:2877
Chan, I., *See* Sishtla, C., 15:2048
Chan, K., *See* Ramos-Izquierdo, L., 15:3164
Chan, K.S., *See* Lindholm, U.S., 15:3243
Chan, Lai-Him, Research in elementary particle physics: Progress report, March 1, 1989–February 28, 1990, 15:3944 (R;US)
Chan, V.S., *See* Chiu, S.C., 15:4312
Chanda, A., *See* Becker, K., 15:4136
Chandel, S.S., Two-centre electron scattering phase shifts calculated to higher orders using the generalized JWKB method, 15:4131 (R;XA)
Chander, S., Enhancement of surface properties for coal beneficiation: Progress report, August 1, 1989–September 30, 1989, 15:2056 (R;US)
Chandler, D.W., *See* Lau, A.M.F., 15:3175
Chang, Cherng, *See* Whitaker, R.B., 15:3380
Chang, G.C., Thermal expansion mismatch and plasticity in thermal barrier coating, 15:2924 (RA;US)
Chang, I.S., *See* Meirovitch, H., 15:3016
Chang, J.C.S., *See* Jozewicz, W., 15:3444
Chang, K.C., *See* Mori, S., 15:3379
Chang, L.K., *See* Planchon, H.P., 15:2500
Chang, L.L., *See* Woronick, S.C., 15:3018
Chang, M.M., Predicting horizontal/slanted well production by mathematical modeling, 15:2115 (BA;US)
Chang, S.G., A process for the preparation of cysteine from cystine, 15:2076 (P;US)
Chang, Y.A., *See* Shiau, F.Y., 15:3014
Chang, Y.C., *See* James, R.B., 15:3177
Chang, Yan-Tyng, *See* Miller, W.H., 15:3079
Chang, Yoon I., Fission energy: The integral fast reactor, 15:2509 (R;US)
Chang, Yun-Ching, *See* Arakawa, E.T., 15:2830
Channell, D.B., *See* Joyce, J.P., 15:2650, 15:2651
Chapela, G.A., Molecular dynamics for discontinuous potential. IV. Lennard-Jonesium, 15:3089 (J;US)
Chaplin, M.R., *See* Shen, S.S., 15:4446
Chapman, C.C., Slurry-fed ceramic melter–A broadly accepted system to vitrify high-level waste, 15:2226 (R;US)
Charak, I., *See* Forrester, R.J., 15:2502
Charbonneau, B.L., *See* Leeper, S.A., 15:2728
Charles, D., *See* Mobbs, S.F., 15:2199
Charlton, L.A., *See* Harris, J.H., 15:4372
Chase, J.B., *See* Pincosy, P.A., 15:4445
See Poulsen, P., 15:3140
Chase, K.L., Selection of an effective biocide and toxicity evaluation for a specific MEOR [microbial enhanced oil recovery] microbial formulation, 15:2114 (R;US)
Chase, L.L., *See* Payne, S.A., 15:3178
Chasman, R.R., *See* Moore, E.F., 15:4107
Chatmon-McEaddy, M., *See* April, R., 15:2769, 15:2770
Chatterjee, A., Radical-induced DNA damage and specific implications in evaluating genetic changes, 15:3722 (RA;DE)
Chattopadhyay, G., Evaluated phase diagrams of binary metal-tellurium systems of the D-block transition elements, 15:2811 (R;IN)
Chau, H.H., *See* Gathers, G.R., 15:3221
Chechik, R., *See* Breskin, A., 15:3346
Chemin, J.F., *See* Stolterfoht, N., 15:4071
Chen Yunmei, Harmonic mappings into manifolds with boundary, 15:4282 (R;XA)
Chen, C.C., Maanshan T_pS_LB accident analysis, 15:2559 (J;US)
Chen, C.H., Absolute rate measurements of two-photon process of gases, liquids, and solids, 15:3174 (J;US)
Chen, C.T., *See* Smith, N.V., 15:2890
Chen, H., Multithermodynamic phase lattice-gas automata incorporating interparticle potentials, 15:4296 (J;US)
Chen, I-Chia, Photofragmentation of ketene to $CH_2(\tilde{X}^3B_1)$ + CO: Dissociation rate, energy release and exit barrier height, 15:3096 (R;US)
Chen, J.G., *See* Shi, D., 15:2947
Chen, J.M., *See* Yang, X.Q., 15:3035
Chen, Jie, *See* Qiu, S.L., 15:4253
Chen, K.-I., *See* Luckhardt, S.C., 15:4323
Chen, M.H., Direct and resonance contributions to electron-impact excitation of n=2 to n=3 transitions in neonlike ions, 15:3907 (J;US)
Effective L-shell fluorescence yields for sodiumlike and neonlike low-lying autoionizing states, 15:3915 (J;US)
Effects of relativity and configuration interaction on L-shell Auger and radiative decays of the doubly excited $3l3l'$ states of sodiumlike ions, 15:3911 (J;US)
Chen, N., *See* Bloom, I., 15:2945
Chen, P., An adiabatic focuser, 15:3277 (R;US)
Chen, Pisin, Coherent pair creation from beam-beam interaction, 15:3278 (R;US)
Chen, S., *See* Chen, H., 15:4296
Chen, S.T., *See* Arastoopour, H., 15:2137
Chen, Y., High resolution spectroscopic detection of acetylene–vinylidene isomerization by spectral cross correlation, 15:3084 (J;US)
Chen, Y.S., *See* Morsi, B.I., 15:2015
Chen, Z.Y., Ar^+_3 photodissociation and its mechanisms, 15:3097 (J;US)
Chenette, D., *See* Shea, M.A., 15:3851
Cheng, C.Y., Final report on the investigation of water purification and waste concentration by the Vacuum Freezing Multiple Phase Transformation Process and its eutectic extension, September 1986-September 1987, 15:3572 (R;US)
Cheng, E., *See* Sharafat, S., 15:4470
Cheng, E.T., Neutronics design of self-cooled lithium blanket and shield for the high wall loading TITAN RFP reactor, 15:4466 (BA;US)
Cheng, H.S., *See* Van Tuyle, G.J., 15:2546
Cheng, R.K., *See* Shepherd, I.G., 15:3108
Cheng, W.C., *See* Cheng, C.Y., 15:3572
Cherhroudi, B., *See* Bardsley, M.E.A., 15:2789
Chernichenko, A.V., Comparative evaluation of efficiency of two methods of preoperative radiotherapy of patients with lung carcinoma, 15:3656 (RA;SU;In Russian)
Chiang, S.H., *See* Morsi, B.I., 15:2015
Chiang, T.C., Performance testing of Method 1312. QA (quality assurance) support for RCRA (Resource Conservation and Recovery Act) testing: Project report, 15:3583 (R;US)
Chiao, L., Challenges in processing for polymer composites, 15:2988 (R;US)
Chiao, T.T., *See* Chiao, L., 15:2988
Chiarelli, P., *See* Morsi, B.I., 15:2015
Chiba, J. and others, *See* Akei, M., 15:3957
Chidume, C.E., Iterative methods for nonlinear set-valued operators of the monotone type with applications to operator equations, 15:4267 (R;XA)
Chilenskas, A.A., Li/FeS battery design for an electric van, 15:2586 (B;US)
Ching, W.Y., Ground-state and optical properties of Cu_2O and CuO crystals, 15:3032 (J;US)

Chirichiello, J.R., Biotechnology research and development activities in industry: 1984 and 1985. Surveys of Science Resources series, 15:3604 (R;US)
Chisholm, D.A., *See* Muench, H.S., 15:3474
Chishti, A.A., *See* McNeill, J.H., 15:4101
Chissov, V.I., Change in proliferative activity of squamous cell and adenogenic carcinomas in the process of radiotherapy as a possible radiosensitivity index, 15:3657 (RA;SU;In Russian)
Chitanvis, S.M., Propagation of a laser beam through self-induced turbulence, 15:3886 (J;US)
Chiu, S.C., Effect of energetic particle absorption on fast wave current drive, 15:4312 (R;US)
Chiu, Shen-yann, Uncontrolled hazardous waste site cleanup programs in the US: An overview, 15:3495 (R;US)
Cho, G., *See* Fujieda, I., 15:3354
Cho, M.H., Characteristics of plasma produced by an RF induction discharge, 15:4364 (BA;US)
Cho, S., *See* Swanson, D.G., 15:4373
Chocol, C., Kestrel 3 Program: Final report, 15:4488 (R;US)
Chodzko, R.A., *See* Bernard, J.M., 15:3149
Chong, C.Y., *See* Mori, S., 15:3379
Chopra, O.K., Embrittlement of cast stainless steels in LWR systems, 15:2513 (R;US)
Irradiation embrittlement of the shippingport neutron shield tank, 15:2442 (R;US)
Chou, F.N.F., Optimal real-time pump and irrigation scheduling for center-pivot sprinkler systems, 15:2724 (R;US)
Christel, L.A., *See* Miner, G.E., 15:2315
Christensen, H.J., *See* Forman, T., 15:2347
Christensen, J.A., Quality oversight in research and development, 15:4495 (R;US)
Christensen, J.J., *See* Izatt, R.M., 15:2443, 15:2444
Christensen, N.E., *See* Norman, M.R., 15:4248
Christenson, P.J., *See* Spong, D.A., 15:4304
Christianson, C.C., *See* Krumpelt, M., 15:2794
See Patil, P.G., 15:2584
Christie, D.J., NTES [Nuclear Test and Experimental Sciences Program] laser facility for physics experiments Building 391 High Bay Option, 15:4442 (R;US)
Chu, B., Evaluation of a linear photodiode array detector for synchrotron small-angle x-ray scattering measurements, 15:3231 (J;US)
Chu, H.P., *See* Flom, Y., 15:2973
Chu, T.L., Thin film cadmium telluride, zinc telluride, and mercury zinc telluride solar cells: Annual subcontract report, 1 July 1988–30 June 1989, 15:2307 (R;US)
Chu, W.K., *See* Haynes, T.E., 15:3001
Chua, Teck-Joo, *See* Robertson, D.W., 15:4520
Chuang, F.Y.S., *See* Frankel, K.A., 15:3677
Chughtai, A.R., *See* Smith, D.M., 15:2344
Chung, H.M., Embrittlement of laboratory- and reactor-aged CF-3, CF-8, and CF-8M duplex stainless steels, 15:2825 (R;US)
See Chopra, O.K., 15:2513
Churchill, J.H., Boundary processes in the nutrient-bearing stratum of the North Atlantic: Progress report, March 1, 1989–February 28, 1990, 15:3818 (R;US)
Ciocco, M., *See* Morsi, B.I., 15:2015
Cirillo, R.R., The generation and control of hazardous waste in the Pacific Basin, 15:3497 (R;US)
Ciskowski, D.E., Cross sections and analyzing powers of $^{15}N(p,n)^{15}O$ at 200 MeV and 494 MeV, 15:4079 (R;US)
Cisper, M.E., *See* Greiner, N.R., 15:3155
Cizewski, J.A., *See* Moore, E.F., 15:4107
Clark, C., *See* Bromborsky, A., 15:4182
Clark, C.F., Capacitive energy storage at cryogenic temperatures. Phase 2. Final report, 1 January 1986-31 December 1988, 15:2560 (R;US)
Clark, G.A., In-situ measurements of coal ash deposit optical properties: Final report, September 11, 1987–September 30, 1989, 15:2096 (R;US)
Clark, M.W., *See* Bernstein, E.M., 15:3926
Clark, N.N., A study of coal particle shape and three-body wear: Quarterly report, August–October 1989, 15:2057 (R;US)
Clark, R.E.H., *See* Zhang, Hong Lin, 15:3896
Clark, R.M., Translating research into practice: The drinking-water industry, 15:3578 (R;US)
Clark, T.L., Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989, 15:3460 (R;US)
Clark, W.J., *See* Osman, R., 15:3703
Claxton, L.D., *See* Driver, J.H., 15:3774
Clemmer, R.G., *See* Sze, D.K., 15:4393
Cleveland, J.C., [Safety related reactor physics calculation for HTGR type reactors]: Foreign trip report, October 3, 1989–October 7, 1989, 15:2455 (R;US)
Clifton, J.R., Service life of concrete, 15:2219 (R;US)
Cline, D.B., Search for proton decay and supernova neutrino bursts with a lunar base neutron detector, 15:3954 (R;XA)
Cline, J.M., Can $\theta_{QCD}=\pi$?, 15:4007 (J;US)
Close, D.M., ESR and ENDOR studies of X-irradiated single crystals of guanine derivatives, 15:3708 (RA;DE)
See Hole, E.O., 15:3712
See Nelson, W.H., 15:3716
See Sagstuen, E., 15:3717
Close, F.E., [Elementary particle interactions]: Progress report, 15:3978 (R;US)
Clough, R.L., *See* Arnold, C. Jr., 15:3036
Coalson, R.D., Cumulant methods and short time propagators, 15:4299 (J;US)
Coats, D., *See* Sherwood, C.R., 15:3819
Cobb, J.K., *See* Fischer, G.E., 15:3309
Cochran, H.D., Molecular clustering in supercritical solutions, 15:3073 (R;US)
Coderre, J.A., Neutron capture therapy for melanoma, 15:3615 (R;US)
Coffey, H.T., *See* Eastham, T.R., 15:2709
Coffman, F., Human Factors Regulatory Research Program Plan, FY 1989–FY 1992: Volume 1, 15:2537 (R;US)
Coggeshall, S.V., *See* Harris, D.B., 15:4437
Cohen, H., *See* Porter, L.C., 15:4252
Cohen, J.M., Self-diffusion on the Lennard-Jones fcc(111) surface: Effects of temperature on dynamical corrections, 15:3093 (J;US)
Cohen, R.H., *See* Matsuda, Y., 15:4327
Cohen, S., *See* Sciacca, F., 15:2543
Cole, G.H., A simplified battery discharge profile based upon the federal urban driving schedule, 15:2577 (R;US)
Cole, W.G., *See* Host, G.E., 15:2298
Colella, R., *See* Buschert, J.R., 15:3017
Coleman, L.W., Recent experiments with the Nova laser, 15:4480 (J;US)
Coleman, M.D., Spectroscopic determination of the electrostatic potential profile in a plasma-prefilled ion diode, 15:3230 (J;US)
Coleman, R.V., *See* Slough, C.G., 15:2893
Colleraine, A., *See* Hong, R., 15:4415
Collins, J.C., *See* Carlitz, R.D., 15:3972
Collins, L.A., Solutions to the time-dependent three-dimensional Schroedinger equation: Atoms in intense electric fields, 15:3930 (J;US)
Collins, R.J., *See* Srivastava, L., 15:2069
Collins, R.T., *See* Schlesinger, Z., 15:2958
Colome, S.D., Pilot investigation of indoor-outdoor and personal PM10 (thoracic) and associated ionic compounds and mutagenic activity. Final report, February 1987-April 1989, 15:3447 (R;US)
Colson, W.B., Theory for high gain, high power free electron lasers: Final report, 15:3166 (R;US)
Combis, P., *See* Naccach, D., 15:4369
Combs, J., Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly, 15:3580 (R;US)
Combs, S.K., Acceleration of small, light projectiles (including hydrogen isotopes) to high speeds using a two-stage light gas gun, 15:4396 (R;US)
See Gouge, M.J., 15:4388
Compton, R.N., *See* Carman, H.S. Jr., 15:3903
Comsa, G., *See* Hall, B., 15:2888
Conaway, J.G., *See* Hearst, J.R., 15:3390
Congemi, J., *See* Tichler, J., 15:2540
Conn, R.W., *See* Hasan, M.Z., 15:4468

Connell, J.R., Advances in three-dimensional turbulence measurement capability, 15:2388 (BA;US)
Connelly, M., *See* Moses, G.A., 15:4461
Conti, L.F., *See* Menlove, H.O., 15:2168
Conti, M., *See* Fujieda, I., 15:3354
Continetti, R.E., *See* Zhao, X., 15:3098
Conzett, H.E., Tests of time reversal invariance via transmission experiments, 15:4023 (R;US)
Cook, D.L., *See* Olson, R.E., 15:4477
Cook, R.J., *See* Milonni, P.W., 15:3922, 15:3929
Cook, T., *See* Pilsner, B., 15:2926
Cooke, D.W., Magnetic ordering in $(Y_{1-x}Pr_x)Ba_2Cu_3O_7$ as evidenced by muon spin relaxation, 15:4256 (R;US)
Microwave characterization of high-temperature superconductors, 15:2921 (R;US)
Rf superconductivity research and development at Los Alamos National Laboratory, 15:3128 (R;US)
Cooke, P.I.H., Divertor design for the TITAN reversed-field-pinch reactor, 15:4469 (BA;US)
See Hasan, M.Z., 15:4468
See Sharafat, S., 15:4470
Coombes, R., *See* Shaw, N.M., 15:3970
Cooper, B.H., *See* McEachern, R.L., 15:3887
Cooper, C.A., Three-dimensional effects in flask impact testing, 15:3123 (R;GB)
Cooper, J.A, One-way transformation of information, 15:4549 (P;US)
Cooper, M.D., $K_L^0 \rightarrow \mu^{\mp}e^{\pm}$ at the Fermilab main injector, 15:3950 (R;US)
Cooper, N.G., Los Alamos Science: AIDS research, 15:3676 (R;US)
Cooper, P.S., *See* Oothoudt, M.A., 15:3297
Cooper, T.C., *See* Caplan, P.E., 15:3456
Cooper, W.S., *See* Inoue, T., 15:4439
See Kwan, J.W., 15:3305
Copeland, R.J., Photoconversion of inorganics to methane. Final topical report, October 1987-February 1989, 15:2267 (R;US)
Cordeiro, J.M., *See* Valverde, N.J., 15:3698
Cordes, G.A., *See* Larson, T.K., 15:4515
Coretsopoulos, C., *See* Oldfield, E., 15:2957
Cornelissen, H.J.M., *See* Van der Wal, J.F., 15:2704
Cornforth, M.N., *See* Carpenter, S., 15:3754
Cort, G.P., *See* Oothoudt, M.A., 15:3297
Corvisiero, P., *See* Viesti, G., 15:4091
Corwin, W.R., *See* Alexander, D.J., 15:4397
Cosgrove, D.J., *See* Rhodes, J.W., 15:3796
Costa Lauria, D. da., Development of sequential analytical method for tne determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)
Costa, D.L., *See* Grose, E.C., 15:3781
Costantino, M.S., *See* Tao, W.C., 15:3382
Cottrell, W.D., Results of the radiological survey at 9 Hancock Street, Lodi, New Jersey (LJ028), 15:3508 (R;US)
Coulomb, F., Parallel algorithms for solving the diffusion equation by finite elements methods and by nodal methods, 15:2470 (R;FR;In French)
Courant, E.D., The evolution of high energy accelerators, 15:3258 (R;US)
Coutinho, M. de F.F., Programs of meteorology in support of nuclear power plants, 15:3475 (R;BR;In Portuguese)
Coutts, T.J., Hybrid solar cells based on DC magnetron sputtered films of n-ITO on APMOVPE grown p-InP, 15:2317 (BA;US)
See Wanlass, M.W., 15:2314
Cover, A.E., *See* Blinn, M.B., 15:2047
Covert, D.S., *See* Frank, R., 15:3787
Cowan, C.E., *See* Geffen, C.A., 15:2243
Cowley, P.J., Integrated computer-based tools to facilitate environmental monitoring, assessment, and restoration, 15:2598 (R;US)
Cox, A.N., Pulsations of B stars: A review of observations and theories, 15:3869 (BA;US)
See Brown, T.M., 15:3874
See Cahn, J.H., 15:3871
See Ostlie, D.A., 15:3872
See Proffitt, C.R., 15:3873
Cox, D.E., Neutron-powder-diffraction study of the structure and antiferromagnetic ordering in Pr_2CuO_4, 15:3031 (J;US)
Cozzens, R.F., *See* Boyle, M.E., 15:3798
Crabtree, G.W., *See* Behroozi, F., 15:2954
Crandall, M.S., Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados, 15:3459 (R;US)
In-depth industrial-hygiene survey report on styrene exposure at Larson Industries, Incorporated Boat Plant, Little Falls, Minnesota, February 27-March 1, 1979, 15:3434 (R;US)
Crane, R.A., Thermal evaluation of advanced solar dynamic heat receiver performance. Final report, January-December 1988, 15:2320 (R;US)
Craun, G., *See* Zierler, S., 15:3771
Crawford, D.L., *See* Yeh, G.J.C., 15:2062
Crawford, J.D., Introduction to bifurcation theory, 15:4310 (R;US)
Crawford, N.M., Sequence and nitrate regulation of the Arabidopsis thaliana mRNA encoding nitrate reductase, a metalloflavoprotein with three functional domains, 15:3607 (J;US)
Crawford, R.K., *See* Jorgensen, J.D., 15:3358
Crawford-Brown, D.J., *See* Adams, F.D., 15:4185
Craxton, R.S., *See* Skupsky, S., 15:3184
Creedon, R.L., *See* Cooke, P.I.H., 15:4469
Creighton, J.R., *See* Kay, B.D., 15:3094
Crissman, B.W., *See* Vukovich, F.M., 15:2128
Crist, C.E., *See* Leifeste, G.T., 15:3895
Croft, W.B., *See* Lesser, V., 15:4498
Crosberg, D.R., *See* Gross, J.M., 15:2247
Crosbie, E., *See* Moncton, D.E., 15:3318
Crosbie, G.M., [Ceramic powder processing]: Foreign trip report, October 7–15, 1988, 15:2930 (R;US)
Crosley, D.R., Laser probes of natural gas ignition chemistry. Annual report, January-December 1988, 15:2153 (R;US)
Cross, L.E., *See* Neurgaonkar, R.R., 15:2809
Crouch, K.G., *See* Caplan, P.E., 15:3456
Crow, J.E., *See* Cooke, D.W., 15:4256
Crowe, K., *See* Amsler, C., 15:3960
Crowley, T.J., *See* Hyde, W.T., 15:3399
Crutcher, J.W., Results of the independent verification of radiological remedial action at 381 East 3rd South Street, Monticello, Utah (MS00140), 15:3511 (R;US)
Results of the independent verification of radiological remedial action at 98 East 5th South Street, Monticello, Utah (MS00076), 15:3512 (R;US)
Results of the independent verification of radiological remedial action at 196 East 3rd South Street, Monticello, Utah (MS00083), 15:3513 (R;US)
Results of the independent verification of radiological remedial action at 384 South 2nd East Street, Monticello, Utah (MS00084), 15:3514 (R;US)
See Foley, R.D., 15:3509, 15:3510
Cruz, A.J., A finite temperature theory of rotationally inelastic diffraction: H_2, HD, and D_2 on Cu(100), 15:4243 (J;US)
Csanady, G.T., *See* Churchill, J.H., 15:3818
Csencsits, R., Electron microscopy study of morphology and composition of a ferrisilicate catalyst, 15:2989 (BA;US)
Csonka, P.L., Theory of elementary particles studies in weak interaction and grand unification and studies in accelerator design: Annual report, Task B, 15:3319 (R;US)
Cugnon, J., Role of mesonic resonances in antiproton annihilation on nuclei, 15:4173 (J;US)
Cujec, B., *See* Brueckner, W., 15:3955
Cukauskas, E., Niobium and niobium nitride contacts on semiconducting material, 15:3233 (P;US)
Culbertson, R.J., *See* Pennycook, S.J., 15:2997
Culik, J.S., High-efficiency silicon concentrator solar cells for use with prismatic covers, 15:2302 (R;US)
Cull, B.A., *See* Waldman, D.J., 15:2801
Cullinan, V., *See* Jacobson, J., 15:3404
Cullis, P.M., DNA damage in frozen aqueous solution: Sequence dependence and end groups, 15:3711 (RA;DE)
Cummings, A.C., The anomalous cosmic-ray component, 15:3862 (RA;US)
See Mewaldt, R.A., 15:3852

Cummins, K.W., Pathogenic regulation of running water macroinvertebrates: Progress report, January 1, 1989–October 15, 1989, 15:3539 (R;US)
Cunningham, G.H., 1988 changes to United States law regarding nuclear third party liability, 15:2615 (R;US)
Cunningham, J., *See* Grothaus, M.G., 15:4365
Cunningham, M., *See* April, R., 15:2766
Curro, J.G., *See* Schweizer, K.S., 15:3022
Curtis, C.W., *See* Kim, H., 15:2049
Curtiss, L.A., Further theoretical studies on B_2H_4 and $B_2H^+_4$, 15:2953 (J;US)
Theoretical study of the ionization of B_2H_5, 15:3928 (J;US)
Theroretical study of $B_2H^+_3$, $B_2H^+_2$, and B_2H^+, 15:3934 (J;US)
Cusatis, C., Determination of X-ray anomalous scattering in silicon, 15:4180 (R;BR;In Portuguese)
Cushman, R.M., *See* Schuhardt, S.L., 15:3396
Custer, D.M., *See* Yavornik, E.J., 15:4460
Cutchin, J.H., *See* August, R.A., 15:3329
Cutting, J.L., *See* Poulsen, P., 15:3140
Czajkowski, C.J., Tensile and impact testing of an HFBR [High Flux Beam Reactor] control rod follower, 15:2457 (R;US)
Czapski, G., Transition metal complexes as sensitizers or protectors against $O_2\cdot^-$ toxicity, 15:3700 (RA;DE)
Czuchlewski, S.J., *See* Rosocha, L.A., 15:4453

D

D'Aiello, R.V., *See* Carlson, D.E., 15:2303
See Catalano, A.W., 15:2304
D'Angelo, S., *See* Rossi, E., 15:2371
D'Ippolito, D.A., *See* Aamodt, R.E., 15:4307
Dabrowski, B., *See* Schlesinger, Z., 15:2958
See Zasadzinski, J.F., 15:4254
See Zhang, K., 15:4250
Dagan, G., Analyses of transport in the upper soil layer and interpretation of caisson experiments, 15:2202 (R;US)
See Nguyen, V., 15:2201
Dagle, G.E., *See* Wehner, A.P., 15:3793
Dahlan bin Haji Mohd, Preparation methodology of radiation - curable resin. Unsaturated polyesters, 15:2255 (R;MY)
See Hussin bin Mohd Nor, 15:2983
Dahlan bin Haji Mohd., *See* Hussin bin Mohd Nor, 15:2984
See Mohamad Hilmi bin Mahmood, 15:3080
Dahlburg, R.B., Numerical simulation of the compressible Orszag-Tang vortex. Interim report, June 1988-February 1989, 15:3935 (R;US)
Dahlinger, M., *See* Schwartz, B., 15:4116
Dahmen, U., Aspects of faceting in the study of percipitate interfaces, 15:2841 (R;US)
Daley, C., *See* Morris, R.E., 15:3453
Daley, T.M., *See* Majer, E.L., 15:3812
Dalgarno, A., *See* Zygelman, B., 15:3913
Dall, H., *See* Olsen, A., 15:3110
Dallas, C.E., Validation and application of pharmacokinetic models for interspecies extrapolations in toxicity risk assessments of volatile organics. Annual report No. 2, 1 July 1988-30 June 1989, 15:3757 (R;US)
Dallman, R.J., *See* Wagner, K.C., 15:2542
Dalrymple, D.A., *See* Trofe, T.W., 15:2143
Dalton, H., Biological and biochemical methane reactions. Final report, March 1986-March 1989, 15:2268 (R;US)
Dalton, M.J., Rheological measurements on cement grouts, 15:2177 (R;GB)
Dalton, T.K., *See* Hunt, W.A., 15:3756
Daly, P.J., *See* McNeill, J.H., 15:4101
Dam-Johansen, K., Hydrogen chloride bonding on dry limestone, 15:3419 (R;DK;In Danish)
See Boll Illerup, J., 15:2428
Danchi, W.C., Frequency dependence of quasi-particle mixers, 15:3118 (R;US)
Inverse a-c Josephson effect at terahertz frequencies, 15:3119 (R;US)
Dandl, R.A., *See* Quon, B.H., 15:4378
Danen, W.C., *See* Finch, F.T., 15:2271
Daniel, B.R., *See* Gal-Ed, R., 15:2152
Daniels, E.K., *See* Minkov, V., 15:2758
Danley, R.A., *See* Zierler, S., 15:3771
Danner, A., *See* Fleckenstein, T., 15:2028
Dao-Gibner, L., *See* Feynman, J., 15:3854
Darken, L.S., Temperature dependence of acceptor-hole recombination in germanium, 15:3012 (J;US)
Darragh, R., *See* Wong, I., 15:3807
Datsenko, V.S., Evolution of radiotherapy methods in breast cancer, 15:3640 (RA;SU;In Russian)
Datta, S.C., *See* Blinn, M.B., 15:2047
Datta, S.S., *See* Wile, J.L., 15:4100
Daum, M.L., *See* Lipfert, F.W., 15:3405
Davenport, A.J., Glancing angle x-ray studies of oxide films: Revision, 15:2903 (R;US)
Davenport, J.W., *See* Fernando, G.W., 15:4247
David, D., Hamiltonian chaos in a nonlinear polarized optical beam, 15:4285 (R;US)
David, M., *See* Nambi, K.S.V., 15:4190
Davie, N.T., *See* Bell, W.K., 15:3389
Davis, A., Enhanced coal liquefaction by low-severity catalytic reactions: Final report, 15:2026 (R;US)
Davis, E.D., Sensitivity of the fluctuating cross-section to time-reversal violation, 15:4144 (RA;DE)
The finite temperature mean-field description and thermal fluctuations, 15:4283 (RA;DE)
See Boose, D., 15:4145
Davis, H.T., *See* Chapela, G.A., 15:3089
Davis, R.W., *See* Crawford, N.M., 15:3607
Davuluri, R.P., *See* Arastoopour, H., 15:2137
Dawson, J.M., Computer simulation of laser plasma interaction: Progress report for 1988, 15:4354 (R;US)
See Wilks, S.C., 15:3279
Dawson, W.D., *See* Cooke, D.W., 15:4256
de Fontaine, D., States of partial order in $YBa_2Cu_3O_z$, 15:2948 (J;US)
de Gravelaine, F., The solitude of a determined inventor, 15:2784 (TG;US)
De Leeuw, S.W., *See* Kalia, R.K., 15:4208
de Manincor, D., *See* Liburdy, R.P., 15:3802
De Sangro, R., *See* Benvenuti, A., 15:3357
De Simone, P., *See* Benvenuti, A., 15:3357
de Souza, R.T., *See* Wile, J.L., 15:4100
de Vore, L., *See* Burnham, A.K., 15:4355
De Vries, P.J., Analysis of forest-fire smoke using satellite imagery. Master's thesis, 15:3384 (R;US)
Dean, E.M., *See* Larson, H.A., 15:2478
Dean, R.S., *See* Foley, W.J., 15:2544, 15:2545
DeBell, D.S., *See* Lester, D.T., 15:2299
Decharge, J., *See* Chaix, P., 15:4507
Deck, J.W., Power circuit breaker test system, 15:2419 (R;US)
Dedina, I.D., *See* Belenkov, Yu.N., 15:3626
Deeba, E.Y., *See* Ahsan, J., 15:4280
Deeble, D.J., Radiation induced release of undamaged uracil from polyuridylic acid and the formation of phosphomonoester end groups in irradiated polynucleotides, 15:3727 (RA;DE)
Dees, D., *See* Redey, L., 15:2575
Dees, D.W., Electrode development in monolithic solid oxide fuel cells, 15:2654 (R;US)
Interfacial effects in monolithic solid oxide fuel cells, 15:2655 (R;US)
Deese, P.L., *See* Ketchum, B.H., 15:3574
Degani, M.H., Nature of phonons, isotope effect, and superconductivity in $Ba_{1-x}K_xBiO_3$, 15:2910 (R;US)
Deis, G.A., *See* Shay, H.D., 15:3167
DeKock, J., *See* Cho, M.H., 15:4364
Delany, J.M., *See* Worlery, T.J., 15:2238
Delegianis, M.J., *See* Hall, E.J., 15:3694
Delettrez, J., *See* Marshall, F.J., 15:4484
Delow, C.E., *See* Mobbs, S.F., 15:2199
DeLuca, W.H., Laboratory evaluation of advanced battery technologies for electric vehicle applications, 15:2582 (B;US)
Status and results of ANL life evaluation of valve-regulated lead-acid load-leveling batteries, 15:2574 (R;US)

DeMarini, D.M., Utility of short-term tests for genetic toxicity, 15:3612 (R;US)
See Watts, R.R., 15:3440
Demasi, J.T., Thermal barrier coating life prediction model development, 15:2927 (RA;US)
Demidchik, E.N., Radionuclidetherapy of metastases of thyroid cancer to lungs, 15:3641 (RA;SU;In Russian)
Demuren, A.O., Calculation of turbulence-driven secondary motion in ducts with arbitrary cross section, 15:3206 (R;US)
denBoer, M.L., *See* Yang, X.Q., 15:3035
Deneye, P., *See* Cugnon, J., 15:4173
Denham, D.H., Recommendations for evaluating environmental monitoring programs for alternative low-level waste facilities, 15:2231 (R;US)
Dennis, R.L., *See* Clark, T.L., 15:3460
Dente, G.C., *See* Park, J., 15:3180
Depaolo, D.J., Isotopic and chemical evolution of planets: Mars as a missing link, 15:3829 (RA;US)
Deppe, L., *See* Wagner, W.J., 15:2378
Derbyshire, F.J., *See* Davis, A., 15:2026
Deser, S., String sources in 2+1-dimensional gravity, 15:4049 (J;US)
Deshpande, N.G., QCD corrections to weak decays, 15:3982 (R;US)
Dessau, D.S., Electronic structure of $Pb_2Sr_2PrCu_3O_8$ as studied by resonant photoemission spectroscopy, 15:2956 (J;US)
See Shen, Z., 15:2960
DeTemple, T.A., Electroabsorption in single quantum-well GaAs laser structures, 15:3150 (R;US)
Deus, S.F., Development of a mathematical phantom for a child with 10 years age for internal dosimetry, 15:4189 (R;BR;In Portuguese)
Devgun, J.S., Effectiveness of interim remedial actions at a radioactive waste facility, 15:2180 (R;US)
Impact of technology applications to the management of low-level radioactive wastes, 15:2182 (R;US)
Devine, M.K., *See* Tam, S.W., 15:2094
deVries, G.J., *See* Kwan, J.W., 15:3305
Dew-Hughes, D., *See* Schmitz, H.A., 15:2875
DeWitte, M.D., The radiation-hardened integrated circuit (RHIC) laboratory: Pursuit of Class 1, 15:3228 (BA;US)
Diamond, P.H., *See* Mattor, N., 15:4375, 15:4376
Dias, J.L., *See* Lima, M.I.C. de, 15:3044
Dick, G.J., *See* Wang, R.T., 15:3161
Dickinson, S., Matrix isolation-infrared and mass spectrometric studies of high-temperature molecules, 15:3039 (R;GB)
See Bowsher, B.R., 15:3069
Dickson, C.R., *See* Ayra, R.R., 15:2305
See Carlson, D.E., 15:2303
See Catalano, A.W., 15:2304
Dierberger, B., *See* Alberich, T., 15:3956
Diez, J.A., Self similar solutions of the second kind of nonlinear diffusion-type equations, 15:4273 (R;XA)
DiMarco, J.N., *See* Thullen, P., 15:4360
DiMeglio, A.F., The conversion of the 2 MW reactor at the Rhode Island Nuclear Science Center, 15:2488 (R;US)
Ding, F.R., Ion-beam mixing and amorphization in Au/Zr bilayers, 15:2859 (BA;US)
Dionne, N., Crossed-field amplifiers as RF drivers for particle beam accelerators, 15:4455 (BA;US)
Dippel, R., *See* Sulzer, G., 15:4228
Diver, R.B., *See* Hogan, R.E., 15:2326
Dix, G.P., *See* Young, A.L., 15:2556
Dixon, L.J., N=2 superconformal symmetry and SO(2,1) current algebra, 15:4025 (J;NL)
Dixon, R.L., Fermilab fixed-target program, 15:3968 (BA;US)
Dixson, R.G., *See* Johnson, L.K., 15:3918
Djilavian, L., *See* Viesti, G., 15:4091
Dmowski, W., *See* Egami, T., 15:2905
Dobosy, R.J., Modeling bulk atmospheric drainage flow in a valley, 15:3400 (J;US)
Doctor, R.D., *See* Livengood, C.D., 15:2420
Dodson, B.W., Scaling relations for strained-layer relaxation, 15:3009 (J;US)
Doebbeling, H., *See* Alberich, T., 15:3956
See Brueckner, W., 15:3955
Doerflinger, D., *See* Burkert, E., 15:3347
Dohrmann, C.R., Time domain structural response calculations for vertical axis wind turbines, 15:2401 (BA;US)
Dolbilkin, B., *See* Khan, S., 15:4089
Doll, G.L., *See* Ohana, I., 15:2937
Doll, J.D., *See* Coalson, R.D., 15:4299
Domagala, R.F., *See* Wiencek, T.C., 15:2164
Dominguez, N., *See* Harris, J.H., 15:4372
Dominguez-Rodriguez, A., Creep of chromia and yttria-doped chromia, 15:2902 (R;US)
Domotor, S.L., Environmental radionuclide concentrations in the vicinity of the peach bottom atomic power station: 1985-1986. Data report, 15:2456 (R;US)
Doncheski, M.A., Flavor-changing decays of the Z^0 and leptoquarks, 15:4015 (J;US)
Donnelly, M., *See* Johnson, R., 15:2648
Donohue, M.D., Prediction of thermodynamic properties of coal derivatives: Progress report, March 1, 1989–February 28, 1990, 15:2054 (R;US)
Donskov, S.V., *See* Alde, D., 15:3969
Doolen, G.D., *See* Chen, H., 15:4296
Dooley, M., *See* Bogo, V., 15:3691
Dorris, S.E., *See* Dees, D.W., 15:2654, 15:2655
Dortch, M.S., *See* Stefan, H.G., 15:3544
Doschek, G.A., *See* Brown, C.M., 15:3925
Douglas, D.L., *See* Henriksen, G.L., 15:2790
Dourson, M.L., *See* Stara, J.F., 15:3779
Dover, C.B., Neutron-antineutron oscillations in nuclei, 15:4070 (R;US)
Dow, J.H., *See* Sacks, M.D., 15:2942
Dowding, R.J., Strain aging in tungsten-heavy alloys. Final report, 15:2810 (R;US)
Dowgiallo, E.J., *See* Burke, A.F., 15:2792
Downey, J.W., *See* Rothman, S.J., 15:2914
Doyle, B.L., *Sse* Knapp, J.A., 15:2853
Dragone, P., *See* Menten, J.O.M., 15:3686
Drake, D.M., *See* Reedy, R.C., 15:3839
Drake, M.J., Accretion and primary differentiation of Mars, 15:3830 (RA;US)
Dransfield, G.D., *See* Yavornik, E.J., 15:4460
Draper, J.V., *See* Kring, C.T., 15:2170
Dravid, N.V., Development and refinement of test bed simulations, 15:2416 (R;US)
Drdlicik-Lex, E., *See* Arnold, W., 15:3321
Drees, A., *See* Breskin, A., 15:3346
Drehmel, D.C., Recent developments of emission control technology in the United States for fossil fuel combustion sources, 15:3249 (R;US)
Dreier, T., *See* Rakestraw, D.J., 15:3377
Drell, S.D., *See* Blankenbecler, R., 15:4016
Dresner, L., *See* Shen, S.S., 15:4478
Dresselhaus, G., *See* Ohana, I., 15:2937
See Withrow, S.P., 15:2994
Dresselhaus, M.S., *See* Ohana, I., 15:2937
Drewery, J., *See* Fujieda, I., 15:3354
Drewry, H.S., Residential cogeneration system development. Annual interim report, February 1988-January 1989, 15:2777 (R;US)
Drigert, M.W., *See* Moore, E.F., 15:4107
Dring, R.P., Measurement of airfoil heat transfer coefficients on a turbine stage, 15:3199 (RA;US)
Driscoll, J.W., Preparing a self-evaluation report for training program accreditation, 15:2460 (R;US)
Dritz, K.W., Rationale for the proposed standard for a generic package of elementary functions for Ada: Revision 1, 15:4504 (R;US)
Driver, J.H., Mutagenicity of combustion emissions from a biomedical-waste incinerator, 15:3774 (R;US)
Drlik, M., *See* Butner, D.N., 15:4358
Drobot, A., *See* Lui, A.T.Y., 15:4367
Drucker, H., Technology transfer in hazardous waste management, 15:2185 (R;US)
The Pacific Basin Consortium: A new device for problems without borders, 15:3496 (R;US)
Drummond, T.J., *See* Fritz, I.J., 15:3008

Drury, L.O'C., Acceleration of cosmic rays in SNR shock waves, 15:3823 (RA;DE;In German)
Dryer, F.L., *See* Yetter, R.A., 15:3087
du Plessis, L.A., The reaction of gaseous iodoethane with silver nitrate, 15:2166 (R;US)
Du, Z., Control of ATP hydrolysis by ADP bound at the catalytic site of chloroplast ATP synthase as related to protonmotive force and Mg^{2+}, 15:3605 (J;US)
DuBois, R.D., Single and double ionization of helium by hydrogen-atom impact, 15:3921 (J;US)
See Bernstein, E.M., 15:3926
Duck, I.M., The sense in which a "weak measurement" of a spin- (1/2 particle's spin component yields a value 100, 15:4293 (J;US)
Dudney, C.S., Investigation of radon entry and effectiveness of mitigation measures in seven houses in New Jersey, 15:2693 (R;US)
See Wilson, D.L., 15:2673
Duerr, W., Tandem accelerators, 15:3263 (RA;DE;In German)
Dugan, P.R., *See* Ward, B., 15:2063
Dugue, J., *See* Ten Brink, H.M., 15:2100
Duke, L.L., Job/task analysis for I&C [Instrumentation and Controls] instrument technicians at the High Flux Isotope Reactor, 15:2492 (R;US)
Dulub, O.I., *See* Petukhov, V.N., 15:3628
Dunham, B., *See* Maruyama, T., 15:3015
Dunlap, J.L., *See* Harris, J.H., 15:4372
Dunlavy, D.J., *See* Olson, J.M., 15:3005
Dunn, G.H., *See* Muller, A., 15:3917
Dunn, J.C., Magma energy extraction: Annual report for FY88, 15:2360 (R;US)
Duong Minh Duc, Solvability in $D^{1,2}(\Omega)$ of the equation $-\Delta u+c=Ke^{u}$, 15:4268 (R;XA)
Duplaa, A.M., *See* Teoule, R., 15:3721
Dupuis, M.C., International cooperation for operating safety, 15:2497 (R;FR;In French)
Trend and pattern analysis of operational data through cooperation between OECD countries, 15:2498 (R;FR)
Durand, D., *See* Quebert, J., 15:4063
Duru, I.H., *See* Barut, A.O., 15:4040
Dussauge, J.P., *See* Fernholz, H.H., 15:3185
Dwight, J.E. Jr., Development of an aging evaluation and life extension program for the Advanced Test Reactor, 15:2521 (R;US)
Dwinell, R., *See* Stover, R., 15:3280
Dworschak, K., *See* Brueckner, W., 15:3955
Dwyer, S.R., *See* Lauer, J.L., 15:2900
Dylla, H.F., *See* Park, H.K., 15:4350
Dzhevechka, I.I., Radiation response in patients with pulmonary carcinoma during remote gamma therapy by means of dynamic multifractionating, 15:3642 (RA;SU;In Russian)
See Mamontov, V.V., 15:3647

E

Early, L., *See* Bromborsky, A., 15:4182
Eastham, T.R., Opportunities and prospects for Maglev in North America, 15:2709 (R;US)
Eastman, J.A., Characterization of nanophase materials by x-ray diffraction and computer simulation, 15:4206 (R;US)
Eather, R.H., Optical instrumentation support for the airborne ionospheric observatory. Report for 1 July 1987-30 June 1988, 15:3884 (R;US)
Eatherly, W.P., [Graphite and carbon/carbon composition]: Foreign trip report, September 17, 1988–September 28, 1988, 15:2979 (R;US)
Eaton, R.R., Predicting flow through low-permeability, partially saturated, fractured rock: A review of modeling and experimental efforts at Yucca Mountain, 15:2234 (R;US)
Eaves, B.C., A class of "onto" multifunctions, 15:4548 (R;US)
Eberhardt, L.E., Trends in radionuclide concentrations for wildlife and food products near Hanford for the period 1971 through 1988, 15:2232 (R;US)
See Rickard, W.H., 15:3515
Ebihara, B.T., *See* Miranda, F.A., 15:2928
Eckerman, K.F., [Environmental transport and health effects of radioactive materials]: Foreign trip report, September 16, 1989–October 7, 1989, 15:3747 (R;US)
Eckert, C.A., Supercritical fluid thermodynamics for coal processing: Quarterly progress report, July 1, 1989–September 30, 1989, 15:2055 (R;US)
Eckhardt, R., *See* Cooper, N.G., 15:3676
Economou, E.N., Calculation of optical transport and localization quantities, 15:2962 (J;US)
Economou, T.E., In situ chemical analyses of extraterrestrial bodies, 15:3831 (RA;US)
Eddleman, J.L., *See* Hartman, C.W., 15:4368
Ederer, D.L., *See* Perera, R.C.C., 15:3019
Edmonds, C.G., *See* Smith, R.D., 15:3371
Edson, J.L., Aging evaluation of electrical circuits using the ECCAD [Electrical Circuit Characterization and Diagnostics] system, 15:2522 (R;US)
Edwards, G. Jr., *See* Fuller, E.N., 15:3063
Edwards, R., *See* Dionne, N., 15:4455
Egami, T., Local atomic displacements in high T_c oxides studied by pulsed neutron scattering, 15:2905 (R;US)
Egelhof, P., *See* Baur, G., 15:4077
Eggert, K.G., *See* Birdsell, K.H., 15:2204
Egido, J.L., Electromagnetic decay of hot rotating nuclei, 15:4150 (RA;DE)
Ehtamo, H., *See* Ruusunen, J., 15:2640
El-Ashry, M.Y., Ion-sound emission by Langmuir soliton reflected at density barrier, 15:4316 (R;XA)
Elderhorst, W.I.M., *See* van der Heijde, P.K.M., 15:3557
Elefsen, F., Diesel-driven heat pump applied to grain drying and chilling. Phase 2, 15:2734 (R;DK;In Danish)
Energy efficient method for evaporating concentrated aqueous solutions of temperature sensitive substances. Phase 1, 15:2733 (R;DK;In Danish)
ElGuebaly, L.A., Blanket and shield design options for ASRA6C: A stellarator power reactor, 15:4467 (BA;US)
Ellefsen, R., *See* Horie, Y., 15:3558
Eller, T., Discretized light-cone quantization: The massless and the massive Schwinger model, 15:3996 (RA;DE)
Elliott, C.J., *See* Schmitt, M.J., 15:3160
Elliott, D.L., Detailed analysis of the wake and free-flow characteristics at the Goodnoe Hills MOD-2 site, 15:2381 (R;US)
Ellis, D.E., *See* Ye, L., 15:3026, 15:3027
Ellis, J.R., Preliminary study of creep thresholds and thermomechanical response in Haynes 188 at temperatures in the range 649 to 871 C, 15:2844 (RA;US)
Ellis, S.D., One-jet inclusive cross section at order α_s^3. I. Gluons only, 15:4011 (J;US)
Ellis, W.P., *See* Shen, Z., 15:2960
Ellison, G.B., Laser photoelectron spectroscopy of ions: Progress report, 1988–1989, 15:3095 (R;US)
Ellison, P.G., *See* Sharon, A., 15:2517
Elwood, J.W., [Ecosystem research on Walker Branch watershed]: Foreign trip report, October 22–28, 1989, 15:3499 (R;US)
Ely, J.F., *See* Friend, D.G., 15:2151
Emery, G.T., *See* Segel, R.E., 15:4081
Emery, K.A., *See* Berry, W.B., 15:2310
See Coutts, T.J., 15:2317
See Wanlass, M.W., 15:2314
Emery, V.J., Phase separation of holes in antiferromagnets, 15:2904 (R;US)
Emling, H., *See* Lubkiewicz, E., 15:4103
Emrich, H.J., *See* Khan, S., 15:4075
See Weber, T., 15:4113
Emrich, M.L., *See* Bratten, W.A., 15:4536
Enbom, S., Efficiency measurements of ventilation, 15:2705 (R;FI;In Finnish)
Ender, C., Status of the data acquisition system for the Crystal Ball, 15:3343 (RA;DE;In German)
See Gerl, J., 15:4115
See Korten, W., 15:4114
See Lubkiewicz, E., 15:4103
Endicott, D.L., *See* Waldman, D.J., 15:2801
Eng, R.S., *See* Kachelmyer, A.L., 15:3147

Engelgau, D.E., *See* Leeper, S.A., 15:2728
Engelke, V., Search for 2-γ decay of the first excited 0⁺ state in ^{98}Mo, 15:4094 (RA;DE;In German)
Engelstad, R.L., *See* Moses, G.A., 15:4461
See Olson, R.E., 15:4477
Englert, P.A.J., Cosmogenic nuclides in the Martian surface: constraints for sample recovery and transport, 15:3832 (RA;US)
Engiman, R., *See* River, N., 15:4261
Englund, D.R., Progress on a PdCr wire strain gage, 15:3369 (RA;US)
Eno, S., *See* Shaw, N.M., 15:3970
Enoeda, M., *See* Sze, D.K., 15:4393
Epperson, J.E., *See* Summerfield, G.C., 15:4203
Epstein, M., *See* Plys, M.G., 15:2515
Erck, R.A., *See* Erdemir, A., 15:2906
Erdemir, A., Solid lubrication of ceramic sufraces by IAD [ion-assisted deposition]-silver coatings for heat engine applications, 15:2906 (R;US)
Erdreich, L.S., *See* Stara, J.F., 15:3779
Erhorn, H., Are the external heat transfer coefficients correct?, 15:2680 (R;DE;In German)
Erickson, K.L., *See* Skocypec, R.D., 15:3381
Erickson, M.D., PCBs in humans: What we know and what we don't know, 15:3759 (R;US)
Erickson, R.M., *See* Holmstrom, B.K., 15:3559
Ericson, J.E., UC accelerator mass spectrometry 1: Proceedings, 15:3364 (R;US)
Eriksson, J., Assessment of RELAP5/MOD2, Cycle 36.04 against FIX-II split break experiment No. 3051, 15:2552 (R;US)
Ernst, K., Bounding dispersion analysis for rare-earth elements as it pertains to the Engineering Demonstration System surrogate testing, 15:3752 (R;US)
Ernst, L., Basic investigation of mixtures consisting of binders and tailings from coal mining with regard to their applicability as building materials in the mining industry, 15:2072 (R;DE;In German)
Ertekin, T., *See* Bezilla, M., 15:2141
Eskra, M.D., *See* Zagrodnik, J.P., 15:2587
Essig, W., *See* Baumann, H., 15:2254, 15:3291, 15:3292
Essington, E.H., Quality-assurance plan for the Basic Environmental Compliance and Monitoring Program (BECAMP), 15:3744 (R;US)
Estep, R.J., A computer study of source-detector geometries proposed for the induced-emission tomography of transuranic elements, 15:3353 (R;US)
Eto, J., *See* Goldman, C.A., 15:2624
Ettedgui, H., *See* Bennett, L.H., 15:2812
Ettinger, R.A., The influence of texture on steady foam flow in Berea sandstone, 15:2109 (R;US)
The influence of texture on steady foam flow in Berea sandstone, 15:2111 (R;US)
Evain, M., *See* Whangbo, Myung-Hwan, 15:4251
Evald, A., Flue gas condensation in stoking system for wood chips, 15:2272 (R;DK;In Danish)
Evans, J.W., Analysis of a diffusion-limited island growth mechanism for chemisorption and epitaxy, 15:3083 (J;US)
Evans, L.G., *See* Lo, I.Y., 15:3355
Evenson, P., Time variation of galactic cosmic rays, 15:3864 (RA;US)
See Mewaldt, R.A., 15:3852
Everett, P.N., 300-Watt dye laser for field experimental site, 15:3143 (R;US)
Everitt, N.M., *See* Atkinson, A., 15:2178

F

Faber, J. Jr., *See* Jorgensen, J.D., 15:3358
Faber, P.M., The ecology of riparian habitats of the southern California coastal region: A community profile, 15:3538 (R;US)
Fabian, R., *See* Arnold, F., 15:3350
Fabrikant, I., *See* Rosander, K., 15:3745
Fabrikant, J.I., *See* Frankel, K.A., 15:3677
See Rosander, K., 15:3745
Fackrell, L.J., *See* Golden, D.W., 15:2520
Fadeeva, I.A., *See* Pavlov, A.S., 15:3670
Fadley, C.S., *See* Jimenez-Mier, J., 15:3923
Fain, B., Two-dimensional spectroscopy: Theory of nonstationary, time-dependent absorption and its application to femtosecond processes, 15:3099 (J;US)
Fainstein, P.D., *See* Stolterfoht, N., 15:4071
Fairchild, R.G., *See* Coderre, J.A., 15:3615
Fajans, J., Waveguide mode deformation in free-electron lasers, 15:3181 (J;US)
Falco, J.W., Assessment of ecologic risks related to chemical exposure: Methods and strategies used in the United States, 15:3772 (R;US)
Methods used in the United States for the assessment and management of health risk due to chemicals, 15:3773 (R;US)
Faler, J.C., *See* Rondorf, D.W., 15:2279
Fang, Y., *See* Rothman, S.J., 15:2914
Farese, L.J., *See* Antal, J.J., 15:3212
Fargus, R.S., *See* John, R.W., 15:2662
Farhi, E., How probability arises in quantum mechanics, 15:4291 (J;US)
Farlow, G.C., *See* McHargue, C.J., 15:2936
Farrington, R., *See* Carlisle, N., 15:2339
Faschingbauer, U., Si ring counters for detection of evaporation residues, 15:3340 (RA;DE;In German)
Fast, R.W., Conceptual design report for a superconducting coil suitable for use in the large solenoid detector at the SSC [Superconducting Super Collider], 15:3333 (R;US)
SSC [Superconducting Super Collider] supplementary conceptual design report: Cryogenics for detectors, 15:3288 (R;US)
Fathy, D., *See* Holland, O.W., 15:2990
Favaro, D.J.F., *See* Armelin, M.J.A., 15:3048
Fearey, B.L., Very high resolution saturation spectroscopy of lutetium isotopes via cw single-frequency laser resonance ionization mass spectrometry, 15:3905 (J;US)
Fechtig, H., *See* Kissel, J., 15:3348
Federer, J.I., High-temperature corrosion of heat exchanger materials, 15:2911 (R;US)
Fedorov, M.B., *See* Musaelyan, R.M., 15:4098
Fehling, D.T., *See* Gouge, M.J., 15:4388
See Shen, S.S., 15:4478
Feinberg, D., *See* Copeland, R.J., 15:2267
Feingold, L., *See* Zierler, S., 15:3771
Feinhals, J., HTO deposition through gas exchange between soil and atmosphere, 15:3507 (R;DE;In German)
Feldman, D.W., *See* Warren, R.W., 15:3156, 15:3157
Feldman, E.E., *See* Planchon, H.P., 15:2500
Feldman, L.C., *See* Headrick, R.L., 15:3006
Feldman, U., *See* Brown, C.M., 15:3925
Feldman, W.C., *See* Reedy, R.C., 15:3839
Fellows, R.J., *See* Cataldo, D.A., 15:3463
Fenske, G.R., *See* Erdemir, A., 15:2906
Ferber, H., *See* Baumann, H., 15:2254, 15:3291, 15:3292
Ferber, M.K., *See* Jenkins, M.G., 15:2913
Ferguson, A.W., *See* Smith, E.O., 15:2070, 15:2071
Ferguson, J.L., *See* Mickley, G.A., 15:3692
Fernandez-Baca, J.A., Spin dynamics of amorphous $Fe_{90-x}Ni_xZr_{10}$, 15:2819 (R;US)
Fernando, G.W., First-principles molecular dynamics for metals, 15:4247 (J;US)
Fernholz, H.H., Survey of measurements and measuring techniques in rapidly distorted compressible turbulent boundary layers, 15:3185 (R;FR)
Ferrante, A., *See* Badirkhan, Z., 15:4217
Ferranti, M., Weld simulated US Mod 9Cr 1 Mo steel: Pt. 1. General microstructure, 15:2817 (R;GB)
Ferris, M.J., *See* Finch, F.T., 15:2271
Feulner, H., *See* Theissig, W., 15:2919
Feynman, J., A new proton fluence model for E greater than 10 MeV, 15:3854 (RA;US)
Interplanetary particle environment. Proceedings of a conference, 15:3361 (R;US)
See Shea, M.A., 15:3851
Fick, D., *See* Becker, K., 15:4097, 15:4136
Fickinger, W.J., *See* Whitehouse, D.A., 15:3971
Field, R.W., *See* Chen, Y., 15:3084
Fields, D.E., *See* Buckley, B.B., 15:3483

See Winkelmann, I., 15:3746
Fieselmann, B., *See* Ayra, R.R., 15:2305
File, J., The lithium blanket program at the LOTUS facility, 15:4465 (BA;US)
Fillius, W., *See* Mewaldt, R.A., 15:3852
Finch, F.T., Development of the foundation for direct conversion of methane to methanol, 15:2271 (B;US)
Findlay, J., *See* Sishtla, C., 15:2048
Findlay, W.O., Testing of indoor radon-reduction techniques in central Ohio houses: Phase 1 (Winter 1987-1988). Report for October 1987-August 1988 (Final), 15:3485 (R;US)
Fingado, B., *See* Liburdy, R.P., 15:3802
Fink, D., *See* Behar, M., 15:4227
Fink, R.K., *See* Burke, A.F., 15:2792
See Larson, T.K., 15:4515
Finlay, P.J., *See* Fernholz, H.H., 15:3185
Finn, P.A., *See* Sze, D.K., 15:4393
Finn, R., *See* Larson, S.M., 15:3682
Fiore, E.M., *See* Herring, R.A., 15:2996
Firsova, P.P., Combined treatment of breast cancer, 15:3655 (RA;SU;In Russian)
Fischer, B., *See* Sulzer, G., 15:4228
Fischer, F., Uncertainty analyses for the atmospheric dispersion submodule of UFOMOD with emphasis on parameter correlations, 15:3481 (R;DE)
Fischer, G.E., Final focus test beam alignment: A draft proposal, 15:3310 (R;US)
Finding the magnetic center of a quadrupole to high resolution: A draft proposal, 15:3309 (R;US)
Fischer, J., *See* Islam, M.M., 15:2617
Fischer, P., *See* Breskin, A., 15:3346
Fischer, R.D., *See* Thirolf, P., 15:4102
Fish, G.E., *See* Fernandez-Baca, J.A., 15:2819
Fisher, A., *See* Tzach, D., 15:4363
Fisher, D.R., The microdosimetry of radon decay products in the respiratory tract, 15:3748 (R;US)
Fisher, J.R., *See* Michael, J.V., 15:3072
Fisher, P.W., *See* Gouge, M.J., 15:4388
Fisk, W.J., Monitoring and modeling for radon entry into basements: A status report for the small structures project, 15:2691 (R;US)
Fitch, J.P., *See* Azevedo, S.G., 15:4530
Fitoussi, L., Dose limits, 15:4192 (R;AU)
Fleckenstein, T., Key chemicals from synthesis gas - development of novel zeolites as catalysts for conversion of methanol into hydrocarbons, 15:2028 (R;DE;In German)
Fleeger, A.K., *See* Crandall, M.S., 15:3459
Fletcher, R.F., *See* Joyce, J.P., 15:2650, 15:2651
Flexser, S., *See* Fisk, W.J., 15:2691
Flom, Y., Fracture toughness of SiC/Al metal matrix composite, 15:2973 (R;US)
Flood, D.J., NASA advanced space photovoltaic technology-status, potential and future mission applications, 15:2296 (R;US)
See Appelbaum, J., 15:2292
Floyd, L.M., *See* Cottrell, W.D., 15:3508
See Foley, R.D., 15:3509, 15:3510
Fluegge, G., Water quality criteria and management models for the tidal region of the Elbe-River, 15:3566 (R;DE;In German)
Fluss, M.J., *See* Wachs, A.L., 15:4258
Flynn, G.W., *See* Hershberger, J.F., 15:3933
Foerstel, H., *See* Steffens, W., 15:3506
Foerster, C.L., *See* Halama, H.J., 15:3285
Foiles, S.M., Thermodynamic properties of fcc transition metals as calculated with the embedded-atom method, 15:2883 (J;US)
Foley, R.D., Results of the radiological survey at 72 Sidney Stret, Lodi, New Jersey (LJ067), 15:3509 (R;US)
Results of the radiological survey at 133 Maywood Avenue, Maywood, New Jersey (MJ025), 15:3510 (R;US)
Foley, R.J., *See* Christie, D.J., 15:4442
Foley, W.J., Closeout of IE Bulletin 86-01: Minimum flow logic problems that could disable residual heat removal pumps: Minimum flow logic problems that could disable residual heat removal pumps, 15:2544 (R;US)
Closeout of IE Bulletin 86-02: Static "O" ring differential pressure switches, 15:2545 (R;US)
Follstaedt, D.M., Phase selection in undercooled liquids of pulsed-laser melted alloys, 15:2865 (BA;US)
See Pope, L.E., 15:2862
Fontes, C.J., *See* Zhang, Hong Lin, 15:3897
Foott, J.S., State of Idaho augmented anadromous fish health monitoring: Annual report, FY 1988, 15:2281 (R;US)
Forman, T., Development of solar collector modules, 15:2347 (R;DK;In Danish)
Fornal, B., *See* Viesti, G., 15:4091
Fornes, R.E., *See* Balik, C.M., 15:3432
Forrester, R.J., Safety aspects of the IFR pyroprocess fuel cycle, 15:2502 (R;US)
See Solbrig, C.W., 15:2459
Forsgren, A.L., A modified Newton method for unconstrained minimization, 15:4547 (R;US)
On the identification of local minimizers in inertia-controlling methods for quadratic programming, 15:4546 (R;US)
Forster, R.A., MCNP [Monte Carlo Neutron Photon] capabilities for nuclear well logging calculations, 15:3378 (R;US)
Fortmann, C., *See* Ayra, R.R., 15:2305
Fortmann, C.M., *See* Carlson, D.E., 15:2303
See Catalano, A.W., 15:2304
Fossum, A.F., *See* Munson, D.E., 15:2233
Foster, C.A., *See* Gouge, M.J., 15:4388
Foster, I., Strand: A practical parallel programming language, 15:4512 (R;US)
Foust, C.R., *See* Combs, S.K., 15:4396
See Gouge, M.J., 15:4388
Fraas, L.M., GaSb booster cells for over 30% efficient solar-cell stacks, 15:2319 (J;US)
Fradkin, E.S., Cubic interaction in conformal theory of integer higher-spin fields in four dimensional space-time, 15:4039 (R;XA)
Solution of a class of conformal quantum field theory models in D-dimensional space, 15:4038 (R;XA)
See Batalin, I.A., 15:4272
Fradkin, L., *See* Bruins, R.J.F., 15:2775
Fradkin, S.Z., *See* Zhakov, I.G., 15:3667
Fradkina, T.E., *See* Batalin, I.A., 15:4272
Fraenkel, Z., *See* Breskin, A., 15:3346
Fralick, G.C., Comparison of turbulence measurement methods, 15:3195 (RA;US)
Frame, E.A., *See* Butler, W.E., 15:2122
Franca, L.P., Error analysis of some Galerkin - least squares methods for the elasticity equations, 15:3192 (R;BR)
Finite element approximations of the stokes flow problem based upon various variational principles, 15:3193 (R;BR)
Strong source heat transfer simulations based on a GalerKin/Gradient - least - squares method, 15:3194 (R;BR)
Francis, C.L., *See* Larson, T.K., 15:4515
Francis, M.W., *See* Cottrell, W.D., 15:3508
Franey, M.A., *See* Hintz, N.M., 15:4064
Frank, D.N., *See* Christie, D.J., 15:4442
Frank, G.A., *See* Bojko, A.V., 15:3638
Frank, H.P., *See* Sulzer, G., 15:4228
Frank, R., Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)
Frankel, K.A., Treatment planning for stereotactic heavy-charged particle radiosurgery of the brain, 15:3677 (R;US)
See Rosander, K., 15:3745
Frantzis, L., *See* Windingland, L.M., 15:2604
Frauenfeld, M., *See* Blum, M., 15:3289
Free, M.E., *See* Rondorf, D.W., 15:2279
Freedman, D.Z., Thirring model on a Riemann surface, 15:4048 (J;US)
Freeman, A.J., *See* Ye, L., 15:3026, 15:3027
Freeman, D.L., *See* Coalson, R.D., 15:4299
Freese, K.E., *See* DiMeglio, A.F., 15:2488
Freisel, M.A., Acoustic emission during integranular stress corrosion cracking, 15:2849 (R;US)
Freitas Brandao Bittenco, Brazilian nuclear policy with respect to the public opinion, 15:2614 (R;BR;In Portuguese)
Frese, M.H., Single fluid simulations of plasma openings switch behavior, 15:3308 (R;US)
Freshley, M.D., *See* Haerer, H.A., 15:3749

See Napier, B.A., 15:3750
Frest, T.J., *See* Neitzel, D.A., 15:3541
Freudenberger, M., Analytical studies of plutonium containing solutions by Laser-Raman-Spectroscopy (LRS) with special regard to the Pu(IV)-Ru(III)-HNO_3 and Pu(VI)-H_2O_2-reactions, 15:3064 (R;DE;In German)
Freyberg, R.W., *See* Kominsky, J.R., 15:3438
Freybery, R.W., *See* Kominsky, J.R., 15:3437
Freyburg, R., *See* Kominsky, J., 15:3451
Fricke, S.H., Coulomb-nuclear interference in elastic heavy-ion scattering, 15:4166 (J;NL)
Friedberg, R., Gap energy and long-range order in the boson-fermion model of superconductivity, 15:4259 (J;US)
Friedlander, G., *See* Beuhler, R.J., 15:4240
Friedman, L., *See* Beuhler, R.J., 15:4240
Friedrich, A., *See* Blum, M., 15:3289
Friedrich, J., *See* Khan, S., 15:4072, 15:4089
See Reiner, K., 15:4085
Friedrichs, H.G., *See* Bracht, K., 15:2495
Frieman, J.A., Cosmic evolution of non-topological solitons, paper 1, 15:3849 (R;US)
Friend, D.G., Tables for the thermophysical properties of methane. Technical note, 15:2151 (R;US)
Friis Pedersen, T., Location of flow separation on an 11 m wind turbine blade by means of flow visualization and a two dimensional airfoil code, 15:2373 (RA;DK)
Fritz, I.J., Electric field response of a semiconductor superlattice optical mirror from electroreflectance spectra, 15:3008 (J;US)
Frohne, K.H., *See* Bezilla, M., 15:2141
Fry, C.A., *See* Shaw, N.M., 15:3970
Fu, G.Y., Excitation of the toroidicity-induced shear Alfven eigenmode by fusion alpha particles in an ignited tokamak, 15:4374 (J;US)
Stability of the Global Alfven Eigenmode in the presence of fusion alpha particles in an ignited tokamak plasma, 15:4308 (R;US)
Fuchs, E.F., Large signal nonlinear model of anisotropic transformers for nonsinusoidal operation: Final report, July 1, 1986–March 30, 1989, 15:3225 (R;US)
Fuehr, F., *See* Steffens, W., 15:3506
Fuja, R., *See* Whitfield, R.G., 15:4505
Fujieda, I., Improved charge collection of the buried p-i-n a-Si:H radiation detectors, 15:3354 (R;US)
Fujiki, Kazuo, *See* Yokobayashi, Masao, 15:2439
Fujimura, T., *See* Sato, T., 15:2786
Fujine, Shigenori, Digital image processing for real-time neutron radiography and its applications, 15:2252 (RA;JP;In Japanese)
Fujisaki, Katsuo, *See* Shimomura, Hiroaki, 15:2454
Fujisawa, Noboru, *See* Tachikawa, Katsuhiro, 15:4424
Fujita, Y., *See* Kring, C.T., 15:2170
Fukuyama, A., *See* Itoh, K., 15:4332, 15:4348
Fuller, E.N., High-temperature gel-permeation chromatography of poly(4-methyl-1-pentene), 15:3063 (R;US)
Fullerton, R., Cure analysis of printed-circuit boards containing reactive adhesive layers, 15:3226 (R;US)
Fullwood, R.R., Probabilistic risk assessment in the nuclear power industry, 15:2616 (B;US)
Fultz, B., *See* Anthony, L., 15:2871, 15:2872
Funatsu, K., *See* Nagase, K., 15:2787
Furieri, E.B., Determination of the protection set-points lines for the Angra-1 reactor core, 15:2441 (R;BR;In Portuguese)
Furuno, K., *See* Bertrand, C., 15:3331

G

Gabbard, W.A., *See* Schwenterly, S.W., 15:4390
Gabbe, D.R., *See* Ohana, I., 15:2937
Gabor, J.D., *See* Forrester, R.J., 15:2502
Gabriel, S., *See* Feynman, J., 15:3361
Gadgil, A.J., *See* Fisk, W.J., 15:2691
Gadsby, K.J., *See* Dudney, C.S., 15:2693
Gaines, L.L., *See* Schmalzer, D.K., 15:2269
Gajdeczko, B., *See* Bardsley, M.E.A., 15:2789
Gal, A., *See* Dover, C.B., 15:4070
Gal-Ed, R., Pulsating catalytic combustion of gaseous fuels. Final report, January 1987-September 1988, 15:2152 (R;US)
Galambos, J.D., *See* Reid, R.L., 15:4459
Galic, H., Weak decays of K and π mesons, 15:4013 (J;US)
Gall, K.P., *See* Whitehouse, D.A., 15:3971
Gallagher, J., *See* Lewtas, J., 15:3784
Gallegos, U.F., *See* Avens, L.R., 15:2203
Gallisch, J.H., Special problems in the exploration and operation of loose-rock open-pit mines in developing and threshold countries, 15:2082 (RA;DE;In German)
Gallo, J., *See* Dallas, C.E., 15:3757
Galvagni, S., *See* Benvenuti, A., 15:3357
Galvin, J.E., Charge state distribution studies of the metal vapor vacuum arc ion source, 15:3302 (R;US)
See Brown, I.G., 15:3301
See MacGill, R.A., 15:3303
Galyean, W.J., *See* Wagner, K.C., 15:2542
Gammel, J.T., *See* Campbell, D.K., 15:4231
Ganapathi, L., Variation of T_{c0} in the 110 K superconductor $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$, 15:2949 (J;US)
Ganchev, A.Ch., $U_q(sl(2))$ invariant operators and minimal theories fusion matrices, 15:4270 (R;XA)
Gandy, R.F., Design of the Compact Auburn Torsatron: [Annual performance report], 15:4399 (R;US)
Gangopadhyay, P., *See* Bardsley, J.N., 15:3914
Gant, K.S., The development and revision of the Federal Radiological Emergency Response Plan, 15:2512 (R;US)
Gao, R.S., *See* Johnson, L.K., 15:3918
Garabedian, P.R., Advanced toroidal theory: Progress report, 15:4306 (R;US)
Garate, E., *See* Tzach, D., 15:4363
Garcia, G.V., Noncontacting laser ultrasonic generation and detection at the surface of molten metal, 15:2834 (R;US)
See Telschow, K.L., 15:2915
Garcia, K.K., *See* Hartmann, F.X., 15:3173
Garcia, P.V., *See* Rhodes, J.W., 15:3796
Gardner, P.R., *See* Bickerstaff, D.D., 15:4532
Gardner, T.W., *See* Alexander, S.S., 15:3814
Garganne, P., Electron beam diagnostics study, 15:3363 (R;FR;In French)
Garrad, A.D., *See* Hill, D.C., 15:2375
Garrett, B.A., *See* Geffen, C.A., 15:2243
Garrett, W.R., *See* Moore, M.A., 15:3176
Garrison, J.A., Compliance testing of the Eglin AFB (Air Force Base) asphalt-concrete Batch Plant, Eglin AFB, Florida. Final report, 5-11 March 1989, 15:3403 (R;US)
Garrison, J.D., A thermally insulating vacuum window, 15:2708 (BA;US)
Garwin, E.L., *See* Maruyama, T., 15:3015
Gasperini, J., *See* Ginsberg, A.P., 15:2558
Gassaly, M., *See* Hintz, N.M., 15:4064
Gathers, G.R., Hugoniot measurements with the LLNL electric gun facility, 15:3221 (R;US)
Gau, G.J.S., *See* Lin, K.C., 15:4521
Gaudette, R.D., Analysis of fallout prediction codes including the Fallout Assessment system (FAS). Master's thesis, 15:3383 (R;US)
Gaudreau, M.P.J., Operating large controlled thermonuclear fusion research facilities, 15:4458 (BA;US)
Gauger, J.R., *See* Haradem, D.P., 15:3795
Gaumert, T., *See* Fluegge, G., 15:3566
Gautney, S.P., *See* Moss, R.D., 15:2413
Gavin, L.M., Design and testing of a superfluid liquid helium cooling loop, 15:3131 (R;US)
Gazdy, B., A three-dimensional L^2 simulation of the photodetachment spectra of $ClHCl^-$ and IHI^-, 15:3100 (J;US)
Gee, J.M., *See* Fraas, L.M., 15:2319
Geer, S., Recent results from the CDF [Collider Detector at Fermilab] experiment at the Tevatron proton-antiproton collider, 15:3953 (R;US)
Geesaman, D.F., *See* Segel, R.E., 15:4081
Geesey, G.G., *See* Gianotto, A.K., 15:2832
Geffen, C.A., Remediation of DOE hazardous waste sites: Planning and integration requirements, 15:2243 (R;US)
Geiger, G.H., *See* Sherman, D.H., 15:2827

Geigl, E.M., *See* Hagen, U., 15:3706
Geiser, U., *See* Porter, L.C., 15:4252
Geller, H., *See* Goldman, C.A., 15:2624
Gelletly, W., *See* McNeill, J.H., 15:4101
Gemmeke, H., *See* Bellm, D., 15:4086
Gemmer, R.V., *See* Gal-Ed, R., 15:2152
Gentner, R., *See* Bellm, D., 15:4086
Gentry, W.O, *See* Zagrodnik, J.P., 15:2587
George, M., Universal null DTE, 15:4534 (P;US)
George, M.C., *See* Venkateswarlu, P., 15:2097
Geppert, D., Flue gas denitrification processes using tissue filters. Final report, 15:2426 (R;DE;In German)
Gerard, P., *See* Jimenez-Mier, J., 15:3923
Gerasimyak, V.G., Possibilities of radiation and combined therapy in treatment of patients with esophagus cancer, 15:3639 (RA;SU;In Russian)
Gerhard, M.A., *See* Pitts, J.H., 15:3172
Gerl, J., Heavy ion induced transfer reactions with ^{232}Th by the Crystal Ball, 15:4115 (RA;DE;In German)
See Engelke, V., 15:4094
See Klatt, C., 15:3341
See Korten, W., 15:4114
See Lubkiewicz, E., 15:4103
See Schirmer, J., 15:4118
German, R.M., Rhenium alloying of tungsten heavy alloys, 15:2808 (R;US)
Gerrity, T.R., Pathophysiological and disease constraints on aerosol delivery, 15:3767 (R;US)
Gerstenberger, D.C., Efficient nonlinear conversion of laser-diode-pumped miniature solid-state laser sources. Final report, 1 May 1986-30 April 1989, 15:3144 (R;US)
Gertis, K., *See* Erhorn, H., 15:2680
Gery, M.W., *See* Morris, R.E., 15:3453
Gessert, T.A., *See* Coutts, T.J., 15:2317
See Wanlass, M.W., 15:2314
Geyer, C., *See* Blum, M., 15:3289
Ghassan, P.G., *See* Leslie, N.P., 15:2697
Ghoniem, N.M., *See* Hasan, M.Z., 15:4468
See Sharafat, S., 15:4470
Ghosn, L. J., Optimum interface properties for metal matrix composites, 15:2975 (R;US)
Gianotto, A.K., The biocorrosion of copper by biopolymers as examined in situ, in real time FT-IR/CIR/ATR in conjunction with pre and post XPS/AES, 15:2832 (R;US)
Gibson, M.W., Recent plutonium metal production experience at Hanford, 15:2171 (R;US)
Giddings, J.C., Field-flow fractionation in the analysis of energy-related materials: Final report, April 1, 1986–March 31, 1989, 15:3545 (R;US)
Gideon, J.A., *See* Caplan, P.E., 15:3456
Gilbert, H., *See* Wong, I., 15:3807
Gilbert, R.D., *See* Balik, C.M., 15:3432
Gilbert, R.O., *See* Haerer, H.A., 15:3749
See Napier, B.A., 15:3750
Gilgallon, J.J., *See* Campbell, G.L., 15:4411
Gill, B.S., Detection of genetic hazards from environmental chemicals with plant test systems, 15:3776 (R;US)
Gill, P.E., *See* Forsgren, A.L., 15:4546, 15:4547
Gill, R.J., *See* Berman, C.H., 15:3114
Gillespie, S.E., *See* Izatt, R.M., 15:2443, 15:2444
Gillette, J.L., *See* Poch, L.A., 15:2759
Gillies, G.T., Magnetically suspended centrifuge for studies of nonlinear phenomena in stratified fluids: Developmental aspects, 15:3211 (J;US)
Gilliom, L.R., A new polymer-based hydrogen getter, 15:2993 (BA;US)
Gillmeister, H., *See* Huebel, K., 15:3567
Gilman, F.J., Rare decays, 15:3965 (R;US)
Ginabreda, M.G.P., Gastrin labelled at IPEN-CNEN/SP-Brazil. Comparison with a commercial tracer, 15:3104 (R;BR)
Ginabreda, P., Quality control of radioimmunoassay technique for gastrine dosage, 15:3622 (R;BR;In Portuguese)
Gindele, K.J., Radiation-physical properties of selective solar absorbers, 15:2346 (R;DE;In German)
Ginley, D.S., *See* Moreland, J., 15:2950
Ginsberg, A.P., Success/simplicity/safety/savings: SI/trip reduction at Indian point 2, 15:2558 (J;US)
Ginsberg, D.M., *See* Rothman, S.J., 15:2914
Giometti, C.S., The current status of two-dimensional electrophoresis in germ cell mutation research, 15:3365 (R;US)
Giovanola, J.H., Influence of microstructure and microdamage processes on fracture at high loading rates. Final report, 1 February 1986-30 September 1988, 15:2806 (R;US)
Girard, G.R., *See* Fraas, L.M., 15:2319
Giroux, J., *See* Korsch, W., 15:3322
See Reich, H., 15:3290
Gitomer, S.J., *See* Warren, R.W., 15:3156
Gjernes, E., *See* Olsen, A., 15:3110
Gladden, J.R., *See* Waldman, D.J., 15:2801
Glaeser, M., Radiation protection measurements at a UA-type teaching kit of sealed radioactive sources, 15:4198 (R;DD;In German)
See Makedanz, A., 15:4199
Glaessel, P., *See* Breskin, A., 15:3346
Glantz, C.S., Meteorological monitoring for environmental/dose assessment and emergency response modeling: How much is enough?, 15:3488 (R;US)
See Laws, G.L., 15:3464
Glasenapp, J., *See* Poepel, H.J., 15:2760
Glasgow, B., *See* Moses, G.A., 15:4461
Glass, J.D., *See* Coderre, J.A., 15:3615
Glass, R.J., *See* Eaton, R.R., 15:2234
Glassgold, A.E., *See* Langer, W.D., 15:3866
Glassley, W., Evaluation of the post-emplacement environment of high level radioactive waste packages at Yucca Mountain, Nevada, 15:2239 (R;US)
Gleason, K., *See* Burnham, A.K., 15:4355
Gleiser, M., Gravitational radiation from primordial solitons and soliton-star binaries, 15:4292 (J;US)
See Frieman, J.A., 15:3849
Gleisner, R.P., *See* Messier, D.R., 15:2967
Glendenning, N.K., Supernovae, compact stars and nuclear physics, 15:3828 (R;US)
Gloudemans, J.R., Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4, 15:2547 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
Multiloop integral system test (MIST): Test Group 35, Noncondensibles and venting: Final report: Volume 7, 15:2549 (R;US)
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)
Glover, C.W., How would you know an intelligent system if you saw one?, 15:4511 (R;US)
See Segel, R.E., 15:4081
Glowienka, J.C., *See* Harris, J.H., 15:4372
Glukhikh, V.A., Status of work on TSP, T-15 and other OTR units, 15:4401 (TG;US)
Glutting, S., *See* May, B., 15:2278
Glynn, P.W., Computational and statistical issues in discrete-event simulation. Technical report, 15:4502 (R;US)
Gnirs, M., Study of multi-fragmentation in collisions of heavy ions, 15:4096 (RA;DE;In German)
Gocksch, A., *See* Aoki, S., 15:4053
Godbole, M.J., Laser-induced interface reactions of copper thin films on sapphire substrates, 15:2878 (J;US)
Godbole, S.P., *See* Kamath, V.A., 15:2156
Goergner, D., State control in the GDR of the handling of unsealed radioactive materials in laboratories of type I to III, 15:4196 (R;DD;In German)
Goerner, H., *See* Tossi, A.B., 15:3733
Goguen, J.A., Rewrite Rule Machine project. Final report, 15:4500 (R;US)
Goh Kian Seong, *See* Mohamad bin Harun, 15:2850
Goins, M.L., Preliminary design of the CIT [Compact Ignition Tokamak] cryostat, 15:4394 (R;US)
Goix, P., *See* Shepherd, I.G., 15:3108
Gold, D.P., *See* Alexander, S.S., 15:3814

Goldberg, A., *See* Sherman, D.H., 15:2827
Goldberg, D.A., Successful observation of Schottky signals at the Tevatron collider, 15:3307 (R;US)
Goldberg, I.H., Oxidative DNA sugar damage by targeted antibiotic free radicals, 15:3704 (RA;DE)
Golden, D.M., *See* Crosley, D.R., 15:2153
Golden, D.W., TMI-2 data qualification and data bases, 15:2520 (R;US)
Golden, G.H., *See* Planchon, H.P., 15:2500
Goldman, A.I., *See* Cox, D.E., 15:3031
Goldman, C.A., Key issues in developing demand-side bidding programs, 15:2636 (R;US)
Least-cost planning in the utility sector: Progress and challenges: Volume 2, Technical appendix, 15:2624 (R;US)
See Kahn, E.P., 15:2635
Goldobenko, G.V., Thermoradiotherapy of patients with recurrences of rectum cancer, 15:3666 (RA;SU;In Russian)
See Isaev, I.G., 15:3643
Goldstein, B., *See* Ayra, R.R., 15:2305
See Catalano, A.W., 15:2304
Goldstein, B.E., High-energy particles very near the sun, 15:3860 (RA;US)
Goldstein, D., Battery actuation of NITINOL at sub-zero temperatures, 15:2572 (R;US)
Goldstein, J.C., Compact rf-linac free-electron lasers, 15:3158 (R;US)
INEX [integrated numerical experiment] simulations of the Los Alamos HIBAF [high-brightness accelerator free-electron laser] free-electron laser MOPA [master oscillator power amplifier] experiment, 15:3298 (R;US)
Optical design and performance of an XUV FEL [free-electron laser] oscillator, 15:3159 (R;US)
Goldstein, S., *See* Czapski, G., 15:3700
Goldston, R.J., *See* Park, H.K., 15:4350, 15:4351
Goldstone, J., *See* Farhi, E., 15:4291
Golightly, W.J., *See* Danchi, W.C., 15:3119
Goltsos, W., Binary micro optics: An application to beam steering, 15:3148 (R;US)
Gombos, F.J., *See* Dravid, N.V., 15:2416
Gomez, A.J., *See* Carne, T.G., 15:2408
Gomez-Jahn, L., *See* Kasinski, J.J., 15:4238
Goncalves Filho, O.J.A., EVP2D- a computer code developed for the eslastoviscoplastic-damage analysis of axyssimetrical and two-dimensional problems, 15:2836 (R;BR;In Portuguese)
Goncalves, M.A., *See* Yamaura, M., 15:3052
Gonzales, S., *See* Benvenuti, A., 15:3357
Goodess, C.M., *See* Jones, P.D., 15:3397
Goodhead, D.T., *See* Carpenter, S., 15:3754
Gooding, J.L., Martian weathering products as tracers of climate change and atmosphere/hydrosphere evolution on Mars, 15:3833 (RA;US)
See Ming, D.W., 15:3835
Goodman, C., *See* Coffman, F., 15:2537
Goodstein, D.M., *See* McEachern, R.L., 15:3887
Goodwin, J.E., *See* Krisch, A.D., 15:3281
Gopalakrishnan, J., *See* Cox, D.E., 15:3031
See Egami, T., 15:2905
Gordon, C.W., *See* Brereton, S.J., 15:3480
Gordon, W.L., *See* Miranda, F.A., 15:2928
Gorel'ko, K.P., *See* Kratenok, V.E., 15:3627
Goretta, K.C., *See* Bloom, I., 15:2945
See Dominguez-Rodriguez, A., 15:2902
See Nash, A.S., 15:2909
Gorienko, V.V., *See* Berezhnov, I.P., 15:3637
Gorney, D.J., *See* Ahn, B., 15:3882
Gosnell, T.R., *See* Tallman, C.R., 15:3170
Gottlieb, S., Four-flavor QCD with intermediate- and light-mass quarks, 15:4060 (J;US)
Gottschalk, R.R., *See* Kronenberg, A.K., 15:2358
Gouanere, M., *See* Alde, D., 15:3969
Gouge, M.J., The ORNL plasma fueling program, 15:4388 (R;US)
See Combs, S.K., 15:4396
Goujdami, D., *See* Quebert, J., 15:4063
Gourley, P.L., *See* Fritz, I.J., 15:3008
Grabisch, K., *See* Baumann, H., 15:2254, 15:3291, 15:3292
Grabmayr, P., *See* Reiner, K., 15:4085
Grabowski, Z.W., *See* Moore, E.F., 15:4107
Grace, J.D., *See* Beno, M.A., 15:4249
Graciotti, M.E., Nursering assistance to the radiological accident patients in Goias-Brazil, 15:3697 (R;BR;In Portuguese)
Graeslund, A., *See* Zell, I., 15:3734
Graf, W., *See* Caldas, L.V.E., 15:3335
Graham, J.A., *See* Grose, E.C., 15:3781
Graham, S.M., Experience with J testing of 304/308 stainless steel weldment, 15:2833 (R;US)
See Smith, D.M., 15:2344
Graham, W.G., *See* Bernstein, E.M., 15:3926
Gramegna, F., *See* Viesti, G., 15:4091
Grammling, F., Computer-aided analysis of heating pipe networks, 15:2681 (R;DE;In German)
Granada, J.C., Magnetoplasma oscillations of the wave-guided type in semiconductor superlattices, 15:4216 (R;XA)
Granholm, A., Evaluation of the contributions made by STU (National Swedish Board for Technical Development) to the sphere of energy. Summary and conclusions, 15:2613 (R;SE;In Swedish)
Grant, C., *See* Azevedo, S.G., 15:4530
Grant, H.P., *See* Hulse, C.O., 15:3367
Grassle, J.F., *See* Maciolek-Blake, N., 15:2130, 15:2131
Gratton, J., *See* Diez, J.A., 15:4273
Graw, G., *See* Korsch, W., 15:3322
Grawert, G., *See* Becker, K., 15:4136
Gray, E.R., *See* Cooke, D.W., 15:2921, 15:3128
Gray, L.B., *See* Joyce, J.P., 15:2650, 15:2651
Gray, R., *See* Morsi, B.I., 15:2015
Gray, R.H., Environmental monitoring for radionuclides, chemicals, fish and wildlife at a US energy research facility: A case story, 15:3751 (R;US)
Gray, S.K., *See* Noid, D.W., 15:3002
Grbic-Galic, D., *See* Roberts, P.V., 15:3554
Greaves, N., *See* Behar, M., 15:4227
Greco, M., Structure functions and initial-final state interference in QED, 15:4042 (R;IT)
Green, M.A., Ground motion measurements at the 1 - 2 GeV synchrotron radiation source site, 15:3299 (R;US)
See Blakers, A.W., 15:2318
See Gavin, L.M., 15:3131
See Pope, W.L., 15:3130
See Schuster, D.P., 15:3681
Greene, S.R., A preliminary modeling and analysis framework for severe accident analysis of high power density research reactors, 15:2528 (R;AT)
Greger, G.U., *See* Bleier, A., 15:2555
Greif, N., *See* Krusche, G., 15:2110
Grein, H., *See* Lubkiewicz, E., 15:4103
Greiner, N.R., Mixing of gases in large volumes by forced injection, 15:3155 (R;US)
Grek, B., *See* Park, H.K., 15:4350
Grelat, A., Preliminary study to a demonstration building climatic design program in the Ivory Coast, 15:2664 (R;FR;In French)
Grenich, A.F., Compatibility of fuel-system components with high density fuel. Final report, April 1987-January 1989, 15:2781 (R;US)
Grepstad, J.K., *See* Braaten, N.A., 15:2891
Grieser, M., *See* Blum, M., 15:3289
Griffin, C.W., *See* Bates, J.L., 15:2659
Griffin, D.C., A review of radiative and dielectronic recombination for C and O ions, 15:3899 (J;SE)
Griffin, J.C., Improved neutron monitor systems for Savannah River Site separations facilities, 15:2165 (R;US)
Griffiths, E.A., *See* Chang, S.G., 15:2076
Grigal, D.F., *See* Ohmann, L.F., 15:3455
Grigolini, P., Brownian motion and finite-temperature effects in the discrete nonlinear Schroedinger equation: Analytic results for the nonadiabatic dimer, 15:4246 (J;US)
Grimsditch, M., *See* Okamoto, P.R., 15:2861
Grimson, J.H., *See* Fast, R.W., 15:3333
Groeb, J., *See* Fleckenstein, T., 15:2028
Groh, M.R., *See* Hester, O.V., 15:4540
Gronsky, R., *See* Csencsits, R., 15:2989

Gropp, C., *See* Bleier, A., 15:2555
Grose, E.C., Chronic exposure to ozone causes restrictive lung disease, 15:3781 (R;US)
Gross, J.M., Applying AI techniques to improve alarm display effectiveness, 15:2247 (BA;US)
Gross, K.C., *See* Lehto, W.K., 15:2505
Grosse, E., *See* Breitbach, G., 15:4105
Grotch, H., *See* Doncheski, M.A., 15:4015
Grothaus, M.G., Study of a plasma edge cathode scheme for electron beam extraction, 15:4365 (BA;US)
Grotz, S., *See* Sharafat, S., 15:4470
Grotz, S.P., *See* Cooke, P.I.H., 15:4469
See Hasan, M.Z., 15:4468
Gruber, J.B., *See* Westrum, E.F. Jr., 15:3021
Gruen, D.M., *See* Kaufherr, N., 15:2818
See Young, C.E., 15:4209
Gruen, E., *See* Pinter, S., 15:4229
Gryning, S.E., *See* Berkowicz, R., 15:3420
Grzadkowski, B., 90-GeV Higgs boson in supersymmetric models, 15:4024 (R;GB)
Gschneidner, K.A. Jr., *See* Kai, K., 15:2955
Guarro, S.B., Prolgraf-B: A knowledge-based system for the automated construction of nuclear plant diagnostic models, 15:2484 (BA;US)
Guendelman, E.I., *See* Blau, S.K., 15:3879
Guhr, T., *See* Habs, D., 15:3270
Guilbault, F., *See* Quebert, J., 15:4063
Gullinger, T.R., *See* Knapp, J.A., 15:2853
Gunadhi, H., *See* Segev, A., 15:4543
Gunion, J.F., Corrections to Higgs-boson-mass sum rules from the sfermion sector of a supersymmetric model, 15:4030 (J;US)
Screening of large supersymmetry breaking in low-energy physics, 15:4029 (J;US)
Using the hadronic multiplicity to distinguish real *W*s from QCD jet backgrounds, 15:4059 (J;US)
Gunnison, D., Sediment-water interactions and contaminants in Corps of Engineers reservoir projects. Final report, 15:3543 (R;US)
Gunter-Smith, P.J., Gamma-radiation affects active electrolyte transport by rabbit ileum. 2. Correlation of alanine and theophylline response with morphology, 15:3689 (R;US)
Guppy, R.M., *See* Atkinson, A., 15:2178
Gupta, R.K., *See* Chandel, S.S., 15:4131
See Khosla, H.S., 15:4130
Gurnett, D.A., *See* Anderson, R.R., 15:3883
Gurney, M.D., Predictability of emissions from in-use vehicles at low-ambient temperature and alternate driving cycle based on standard tests, 15:2788 (B;US)
Gussenhoven, M.S., *See* Mullen, E.G., 15:3881
Gutfinger, C., *See* Shapiro, M., 15:3402
Guth, M.A.S., Incorporating fuzzy data and logical relations in the design of expert systems for nuclear reactors, 15:2483 (BA;US)
Gutmann, S., *See* Farhi, E., 15:4291
Gvildys, J., *See* Wang, C.Y., 15:2503
Gyorey, G.L., *See* Pedersen, D.R., 15:2501
Gyufko, R., α-scattering on ^{100}Mo, 15:4092 (RA;DE;In German)
Results of the α-scattering on the even, stable Ge isotopes, 15:4090 (RA;DE;In German)
Systematics of the (^{16}O,^{20}Ne) reaction and the determination of the mass excess of ^{122}Cd, 15:4093 (RA;DE;In German)
Gyulassy, M., Testing string dynamics in lepton nucleus reactions, 15:4067 (R;US)
Theoretical issues in the search for the quark gluon plasma, 15:4162 (R;US)

H

H.R., *See* Berkowicz, R., 15:3420
Haakanson, L., *See* Nilsson, Aa., 15:3565
Haapalahti, P., Heating energy flexibility of dwellings, 15:2706 (R;FI;In Finnish)
Habenschuss, A., X-ray diffraction study of liquid *n*-butane at 140 and 267 K, 15:3088 (J;US)
Habib, H.M., Effect of non-absorbable gas on the performance of a falling film absorber for open-cycle absorption solar cooling system, 15:2336 (BA;US)
Habs, D., Beam crystallization, 15:3270 (RA;DE;In German)
See Achenbach, W., 15:4117
See Baumann, W., 15:3293, 15:3294, 15:3345, 15:3889, 15:3890
See Engelke, V., 15:4094
See Gerl, J., 15:4115
See Hennrich, H.J., 15:4095
See Huenemohr, H., 15:4078
See Klatt, C., 15:3341
See Korten, W., 15:4114
See Kramp, J., 15:3344
See Lubkiewicz, E., 15:4103
See Schirmer, J., 15:4118
See Schwartz, B., 15:4116
See Thirolf, P., 15:4102
Hadden, J.D., *See* Wang, T.F., 15:4082
Hadvig, S., *See* Kampp Rasmussen, N.B., 15:3113
See Olsen, A., 15:3110
Haemaelaeinen, R.P., *See* Ruusunen, J., 15:2640
Haerer, H.A., The Hanford Environmental Dose Reconstruction Project: Overview, 15:3749 (R;US)
See Napier, B.A., 15:3750
Hafizi, B., Radiation of a finite electron-beam pulse in a free-electron laser amplifier, 15:4456 (BA;US)
Hagen, U., Radiation induced clustered damage in DNA, 15:3706 (RA;DE)
Hagenson, R.L., *See* Krakowski, R.A., 15:4342
Hagimoto, K., *See* Hirano, T., 15:2695
Hahgighi, H., *See* Wachs, A.L., 15:4258
Hahn, H.A., Model for measuring complex performance in an aviation environment, 15:3127 (R;US)
Where to from here? Future applications of mental models of complex performance, 15:2480 (R;US)
Hahn, W., *See* Blum, M., 15:3289
Hair, L.M., Gels and foams from ultrahigh molecular weight polyethylene, 15:2986 (R;US)
Hajduk, J.C., On the topic of single and multicomponent chemisorption isotherms, 15:2092 (R;US)
Hajek, T.J., Coolant passage heat transfer with rotation, 15:3201 (RA;US)
Halama, H.J., Comparison of photodesorption yields from aluminum stainless and Cu-plated beam tubes, 15:3285 (R;US)
Pretreatment and conditioning of storage ring vacuum systems, 15:3315 (R;US)
Haldipur, G.B., *See* Blinn, M.B., 15:2047
Haldy, P.A., *See* File, J., 15:4465
Hale, P.D., Amperometric biosensors for glucose, lactate, and glycolate based on oxidases and redox-modified siloxane polymers, 15:3600 (R;US)
Hales, J.M., Climate change and its effect on wet-removal processes, 15:3395 (B;US)
Halford, G.R., Total strain version of strainrange partitioning for thermomechanical fatigue at low strains, 15:2846 (RA;US)
Hall, B., Anharmonic damping in rare-gas multilayers, 15:2888 (J;US)
Hall, E.J., Radiation physics, biophysics, and radiation biology: Progress report, December 1, 1988–November 30, 1989, 15:3694 (R;US)
The Radiological Research Accelerator Facility: Progress report, December 1, 1988–November 30, 1989, 15:3695 (R;US)
Hall, H.L., Delayed-fission properties of neutron-deficient americium nuclei, 15:4120 (R;US)
Hall, L.J., *See* Brahm, D.E., 15:4031
Hall, L.N., *See* Behroozi, F., 15:2954
Hall, R.E., *See* Fullwood, R.R., 15:2616
Hall, S.H., Evaluation of the ground-water contaminant plume extending from the 183-H Solar Evaporation Basins, 15:2225 (R;US)
Haller, K., Proceedings of the Storrs meeting, 15:3942 (B;US)
Halliwell, J., *See* Stover, R., 15:3280
Halsnaes, K., Simulation of the Italian energy system with the DESS-model, 15:2626 (R;DK)
Hamamatsu, K., *See* Itoh, K., 15:4332
Hamano, K., *See* Krall, A.H., 15:3210

Hamburg, G., *See* Ten Brink, H.M., 15:2100
Hamby, D.C., High-power-density prime power systems: A literature search and analysis, 15:2581 (R;US)
Hamer, N., *See* Fain, B., 15:3099
Hamilton, D.C., The radial dependence of the solar energetic particle flux, 15:3856 (RA;US)
See Shea, M.A., 15:3851
Hamilton, J.C., Optical second harmonic generation from Ni(110) with adsorbed CO, 15:2879 (J;US)
Hamilton, R.J., Statistical study of the correlation of hard X-ray and type 3 radio bursts in solar flares, 15:3850 (R;US)
Hamilton, W., Electric and hybrid vehicles: Technical background report for the DOE flexible and alternative fuels study, 15:2791 (R;US)
Hammer, D.A., *See* Coleman, M.D., 15:3230
Hammer, J.H., *See* Hartman, C.W., 15:4368
Hammersley, R.J., *See* Plys, M.G., 15:2515
See Sharon, A., 15:2517
See Suh, K.Y., 15:2438
Hampel, W., *See* Burkert, E., 15:3347
Hamrick, P.E., *See* Adams, F.D., 15:4185
Hamza, A.V., Adsorption of NO on diamond C(111)-(2×1) by band-gap excitation, 15:3003 (J;US)
Han, O.H., *See* Oldfield, E., 15:2957
Hanada, M., *See* Inoue, T., 15:4439
Hanada, Masaya, *See* Okumura, Yoshikazu, 15:4426
Hanatani, K., *See* Itoh, K., 15:4348
Handin, J., *See* Kronenberg, A.K., 15:2358
Hankins, M.R., *See* Gianotto, A.K., 15:2832
Hanlon, J.A., *See* Rosocha, L.A., 15:4453
Hansen, H.H., Annual progress report on nuclear data 1987, 15:4193 (R;FR)
Hansen, J.P., Coupled-channel calculations of partial capture cross sections in multiply charged ion collisions with hydrogen, 15:3924 (J;US)
Hansen, W.L., *See* Shan, W., 15:3033
Hanson, J.D., *See* Gandy, R.F., 15:4399
Hansson, T.H., Quark-mass dependence of the chiral model parameters, 15:3998 (RA;DE)
Harada, H., *See* Shaw, N.M., 15:3970
Harada, M., *See* Motojima, O., 15:4441
Haradem, D.P., ELF (extremely low frequency) communications system ecological monitoring program: Electromagnetic field measurements and engineering support – 1988. Technical report, 1982-1988, 15:3795 (R;US)
Harami, Taikan., Flux and power spectra of photon sources from bending magnets and insertion devices at a 8 GeV storage ring, 15:3324 (R;JP)
Undulator sources at a 8 GeV storage ring, 15:3323 (R;JP)
Hardin, T.L., Seismic signal modeling of the RSTN and the NORESS/ARCESS data, 15:3815 (R;US)
Hardy, D.A., *See* Mullen, E.G., 15:3881
Harkness, J.B.L., Combined NO_x/SO_2 control technology, 15:2421 (R;US)
Harmon, B.N., *See* Zhao, G., 15:2892
Harmon, D.L., Mobile air-conditioner refrigerant evaluation. Report for April 1988-March 1989, 15:3441 (R;US)
Harmon, J.R., Use of a fish transportation barge for increasing returns of steelhead imprinted for homing: Final report, 15:2280 (R;US)
Harney, H.L., On a class of integrals appearing in the theory of statistical nuclear reactions, 15:4147 (RA;DE)
The statistical theory of nuclear reactions in the limit of isolated resonances, 15:4148 (RA;DE)
See Mueller, A., 15:4146
Harrach, D. von, *See* Alberich, T., 15:3956
Harris, B.G., Seismic design criteria at the Idaho National Engineering Laboratory (INEL), 15:3808 (R;US)
Harris, D.B., Design and performance of future KrF laser-fusion facilities, 15:4437 (R;US)
See Williamson, A.D., 15:2696
Harris, J., Fan pressurization test results from the residential construction demonstration project: Cycle 1, 15:2666 (R;US)
See Goldman, C.A., 15:2624
See Kalia, R.K., 15:4208
Harris, J.A., Extended range tankless water heater: Quarterly report No. 2, July 20, 1989–October 19, 1989, 15:2671 (R;US)
Extended range tankless water heater: Quarterly report, April 19–July 19, 1989, 15:2725 (R;US)
Harris, J.H., Second stability in the ATF torsatron, 15:4372 (J;US)
Harris, S.E., Lasers without inversion: Interference of lifetime-broadened resonances, 15:3152 (R;US)
Non-reciprocity of autoionizing interferences: Lasers without inversion, 15:3151 (R;US)
Harris, W.M., Federal offshore statistics, 1987: Leasing exploration, production, and revenues, 15:2106 (R;US)
Harrison, G.C., Research, development, training, and education using the Ada programming language. Final report, 1 September 1987-31 May 1989, 15:4503 (R;US)
Harrison, J.F., *See* Oothoudt, M.A., 15:3297
Harrison, L., *See* Michalsky, J.J., 15:2699
Harrje, D.T., *See* Dudney, C.S., 15:2693
Hartle, M., *See* Pilsner, B., 15:2926
Hartman, C.W., Reflection of accelerated plasma rings from conical electrodes in the RACE experiment, 15:4368 (BA;US)
Hartmann, F.X., Dynamics of coupled electron-nucleon motion in a laser field, 15:3173 (J;US)
Hartmann, U., *See* Habs, D., 15:3270
Harvey, P., *See* Moslehi, B., 15:3373
Harvey, P.R., *See* Nelson, R.S., 15:3247
Harvey, W.F., *See* Carpenter, S., 15:3754
Harvill, T.L., *See* Holve, D.J., 15:3469
Harwell, J.H., *See* Wu, R., 15:3932
Hasan, M.Z., Thermal-hydraulic design for the lithium-cooled TITAN reversed-field-pinch reactor, 15:4468 (BA;US)
See Cooke, P.I.H., 15:4469
Hasegawa, M., *See* Chen, Z.Y., 15:3097
Hash, M.C., *See* Bloom, I., 15:2945
Hashimito, O., *See* Shintomi, T., 15:3296
Hasinoff, M.D., *See* Whitehouse, D.A., 15:3971
Hassan, S.Q., Steam stripping and batch distillation for the removal/recovery of volatile organic compounds, 15:2736 (R;US)
Hassan, Y.A., *See* Bagwell, T.G., 15:3209
Hassler, T.J., *See* Stein, D., 15:3537
Hasti, D.E., *See* Haworth, M.D., 15:3275
Hatch, G.E., *See* Grose, E.C., 15:3781
Hatch, J., *See* Smith, J.R., 15:4451
Hatchell, P.J., *See* Fricke, S.H., 15:4166
Hattemer-Frey, H.A., A perspective on human exposure to PCDDs and PCDFs emitted form municipal waste combustors, 15:3758 (R;US)
Haubelt, R., *See* Winkelmann, I., 15:3746
Hauck, A.K., *See* Foott, J.S., 15:2281
Haumann, J.R., *See* Jorgensen, J.D., 15:3358
Hauserman, W.B., Test plan for valveless ash removal from pressurized fluid bed combustion systems, 15:2095 (R;US)
Haustein, P.E., Atomic mass measurements with radioactive beams and/or targets: Where to start, 15:3070 (R;US)
Hauth, G., *See* Kiko, J., 15:4151
Hawk, D., *See* Ketoff, A., 15:2646
Hawk, D.V., The role of oil in electricity generation in five European countries: Past, present, and potential, 15:2631 (R;US)
Hawke, R.S., *See* Asay, J.R., 15:3220
See Poulsen, P., 15:3140
Hawkins, H.G., *See* Mounce, J.M., 15:2711
Hawkins, R.J., *See* Smith, J.R., 15:4451
Haworth, M.D., Summary of RLA [Recirculating Linear Accelerator] beam transport experiments using a 1.5 MV injector, 15:3275 (R;US)
Hawryluk, R.J., *See* Park, H.K., 15:4350
Hawthorne, A.R., *See* Dudney, C.S., 15:2693
Haxton, W., *See* Ying, S., 15:3985
Hayakawa, Naohiro, *See* Itoh, Hisayoshi, 15:2920
Hayashi, S., *See* Kring, C.T., 15:2170
Hayatsu, R., *See* Botto, R.E., 15:2052
Hayden, H.C., *See* Tan, Z., 15:3028
Hayes, A.F., *See* Sherman, D.H., 15:2827
Hayes, E.F., *See* Walker, R.B., 15:3931

Hayes, G.R., Quality Assurance in the removal and transport of the TMI-2 core, 15:2523 (R;US)
Haymaker, R., *See* Chan, Lai-Him, 15:3944
Haynes, H.D., Evaluation of check valve monitoring methods, 15:2479 (R;US)
Haynes, L.C., *See* Warren, R.W., 15:3156
Haynes, T.E., Ion beam modification of film stress and the effectiveness of thin film encapsulants on GaAs, 15:3001 (BA;US)
Hazeltine, R.D., Self-consistent radial sheath, 15:4380 (J;US)
Hazucha, M., *See* Benignus, V.A., 15:3755
Head, J.L., *See* Billone, M.C., 15:2504
Headrick, R.L., Structure determination of the Si(111):B($\sqrt{3}\times\sqrt{3}$)*R*30° surface: Subsurface substitutional doping, 15:3006 (J;US)
Hearst, J.E., *See* Zhu, Yu Sheng, 15:3606
Hearst, J.R., Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole, 15:3390 (R;US)
Heaton, R.C., *See* Greiner, N.R., 15:3155
Hecht, K.T., *See* Habs, D., 15:3270
Heck, R., *See* Duerr, W., 15:3263
Heck, U., *See* Nouvel, P., 15:4517
Heckes, A.A., *See* Nelson, R.F., 15:2325
Heckman, G.R., Solar proton event forecasts, 15:3857 (RA;US)
See Shea, M.A., 15:3851
Hedman, B.A., *See* Poch, L.A., 15:2759
Hedrick, R.L., *See* Leslie, N.P., 15:2697
Heermann, D.F., *See* Chou, F.N.F., 15:2724
Heiberger, J.J., *See* Dees, D.W., 15:2654, 15:2655
Heidner, R.F., *See* Bott, J.F., 15:3146
Heikkinen, Pauli., Beam dynamical studies of cryring. Quarterly report 3. quarter 1987, 15:3325 (R;FI)
Heil, R.D., *See* Weber, T., 15:4113
Heim, J.R., *See* Shen, S.S., 15:4446
Heinemann, K., *See* Zeuner, G., 15:3392
Heinen, V.O., *See* Miranda, F.A., 15:2928
Heinicke, J.J., Applicability of the DMSO (dimethyl sulfoxide) aggregate degradation test to determine moisture-induced distress in asphalt-concrete mixes. Final report, June 1986-June 1987, 15:2980 (R;US)
Heinonen, R., *See* Lilja, R., 15:3251
Helgason, R.V., *See* Kennington, J.L., 15:4501
Helleis, F., *See* Arnold, F., 15:3350
Hellmann, H., *See* Theissig, W., 15:2919
Hellsten, S., Ecological aspects of lake regulation in Northern Finland. Part 2. Geomorphology and vegetation of the littoral zone, 15:2287 (R;FI;In Finnish)
See Alasaarela, E., 15:2290
See Huusko, A., 15:2289
See Tikkanen, P., 15:2288
Helmolt, U. v., *See* Gerl, J., 15:4115
See Klatt, C., 15:3341
See Korten, W., 15:4114
Hemberger, K.H., *See* Blum, M., 15:3289
Hemberger, P.H., *See* Greiner, N.R., 15:3155
Henderson, D.L., *See* Olson, R.E., 15:4477
See Yasar, O., 15:2557
Henderson, J.R., *See* Brown, C.M., 15:3925
Henderson, M.A., *See* Gandy, R.F., 15:4399
Hendrey, G.R., *See* Lipfert, F.W., 15:3405
Hendricks, J., *See* Chocol, C., 15:4488
Hendricks, K.J., Experimental study of microwave transmission through a decaying plasma. Final report, January 1986-February 1988, 15:3936 (R;US)
Hendrickson, F.R., *See* Lennox, A.J., 15:3619
Henesian, M.A., *See* Christie, D.J., 15:4442
Henley, E.M., Chiral symmetry restoration and quasi-elastic electron-nucleus scattering, 15:4019 (R;US)
Space-time symmetries in nuclei, 15:4127 (R;US)
Status of time reversal invariance, 15:4018 (R;US)
See Ying, S., 15:3985
Henline, P., Upgrade plans to handle 30 to 40 Mbytes of data for DIII-D, 15:4409 (R;US)
Henneck, R., *See* Baur, G., 15:4077
Hennick, A., *See* Foley, W.J., 15:2544, 15:2545
Henning, C.D., ITER [International Thermonuclear Experimental Reactor] in perspective, 15:4452 (R;US)
Hennion, B., *See* Fernandez-Baca, J.A., 15:2819
Hennion, M., *See* Fernandez-Baca, J.A., 15:2819
Hennrich, H.J., γ-multiplicity distributions for fusion reactions at and below the barrier, 15:4095 (RA;DE;In German)
Henriksen, G.L., Assessment of EV batteries and application to R and D planning, 15:2588 (B;US)
Battery technology assessment and R and D plan, 15:2793 (R;US)
National program plan for electric vehicle battery research and development: Technical plan, 15:2790 (R;US)
See Ratner, E.Z., 15:2576
Henrikson, S., Sensitivity to hydrogen embrittlement in connection with cathodic protection of stainless duplex steels, 15:2854 (R;SE;In Swedish)
Henry, R.E., *See* Sharon, A., 15:2517
Henschel, D.B., *See* Mosley, R.B., 15:3484
Hentschel, D., Design and test of a MR-imager with superconducting magnet. Final report, 15:3624 (R;DE;In German)
Hercules, D.M., Characterization of oxidized coal surfaces: Final report, 15:2061 (R;US)
Herman, H, *See* Carlson, L.W., 15:3141
Hermansson, B.R., Beam propagation, 15:3992 (R;SE)
Hermes, G.L., *See* Christie, D.J., 15:4442
Hermsmeier, B., *See* Jimenez-Mier, J., 15:3923
Hermuen, M., *See* Jauhiainen, J., 15:2682
Herold, G., *See* Althaus, E., 15:2359
Herrera, J., Random errors in the magnetic field coefficients of superconducting quadrupole magnets, 15:3327 (BA;US)
Herrin, J.P., *See* Hassan, S.Q., 15:2736
Herring, R.A., Recrystallization characteristics of amorphous Si, 15:2996 (BA;US)
Herrmann, C., *See* Fleckenstein, T., 15:2028
Herron, J.T., Kinetics data base for combustion modeling: Status report, February 1, 1988–January 31, 1989, 15:3107 (R;US)
Hershberger, J.F., Quantum state-resolved study of pure rotational excitation of CO_2 by hot atoms, 15:3933 (J;US)
Hershkowitz, N., *See* Cho, M.H., 15:4364
Hertzberg, R.C., *See* Stara, J.F., 15:3779
Herzenberg, C.L., *See* Schmalzer, D.K., 15:2269
Herzog, J.P., SASSYS validation with the EBR-II shutdown heat removal tests, 15:2506 (R;US)
Hespanhol, C.B., *See* Brandao Filho, D., 15:2169
Hesse, A., Determination of the dependence of engine characteristics on the properties of alternative fuels, 15:2800 (R;DE;In German)
Hesse, D., Shaping of working conditions for handicapped persons according to results of human-engineering research in hardcoal mining - main phase. Final report, 15:2103 (R;DE;In German)
Hessey, N.P., *See* Whitehouse, D.A., 15:3971
Hester, O.V., Environmental data qualification system, 15:4540 (R;US)
Heuser, B., *See* Summerfield, G.C., 15:4203
Heusser, G., *See* Burkert, E., 15:3347
Heuze, F.E., Understanding the effect of natural fractures on the hydrofracture stimulation of gas reservoirs, 15:2148 (BA;US)
Hewett, D.W., 2.5D EM direct implicit PIC simulation using AVANTI, 15:4356 (R;US)
See Langdon, A.B., 15:4357
Hewitt, S.A., *See* Hershberger, J.F., 15:3933
Heyde, K., *See* Casten, R.F., 15:4172
Heyng, H.W., *See* Ender, C., 15:3343
See Korten, W., 15:4114
Hicks, B.B., *See* Lenschow, D.H., 15:3393
Hielscher, D.G., *See* Arnold, W., 15:3321
Higgins, M., *See* Moorhead, P.E., 15:3245
Highland, V.L., *See* Auerbach, L.B., 15:3951
Hildenbrand, D.L., Dissociation energy of the molecule AlBr from equilibrium measurements, 15:3092 (J;US)
Hildenbrand, K., ESR studies on the mechanism of ·OH-induced strand breakage of Poly(U), 15:3730 (RA;DE)
Hill, D.C., Design of aerofoils for wind turbine use, 15:2375 (RA;DK)
Hill, D.N., *See* Rensink, M.E., 15:4450

Hillebrand, K., Calculation of peat production expenses, 15:2088 (R;Fl;In Finnish)
Hillery, R., *See* Pilsner, B., 15:2926
Hills, R.G., *See* Wierenga, P.J., 15:2218
Hinks, D., *See* Egami, T., 15:2905
Hinks, D.G., *See* Behroozi, F., 15:2954
See Beno, M.A., 15:4249
See Schlesinger, Z., 15:2958
See Zasadzinski, J.F., 15:4254
See Zhang, K., 15:4250
Hintsa, E.J., *See* Zhao, X., 15:3098
Hintz, N.M., Nuclear structure studies at intermediate energies: Interim progress report, 1988–89: September 1988–August 1989, 15:4064 (R;US)
Hirabayashi, Noriaki, *See* Watanabe, Yasuo, 15:3892
Hirakawa, Naohiro, *See* Baba, Mamoru, 15:4119
Hiraki, N., *See* Itoh, S., 15:4418
Hirano, T., Development of high-efficiency scroll compressors for air conditioners, 15:2695 (R;JP)
Hiraoka, Toru, Design study of high breeding fast reactor. FP gas purge/tube-in-shell metallic fuel fast reactor, 15:2462 (R;JP;In Japanese)
Hiratsuka, Hajime, Upgrade of JT-60 pellet injector for higher velocity, 15:4423 (R;JP;In Japanese)
Hirning, R., *See* Baumann, H., 15:2254, 15:3291, 15:3292
Hirota, Koichi, *See* Hiraoka, Toru, 15:2462
Hirschmugl, C.J., *See* Williams, G.P., 15:3283
Hirsekorn, R.P., *See* Storck, R., 15:2198
Hirst, E., Guidelines for a "good" integrated resource plan, 15:2632 (R;US)
See Goldman, C.A., 15:2624, 15:2636
Hirvonen, A., *See* Huusko, A., 15:2289
Hitterman, R.L., *See* Jorgensen, J.D., 15:3358
See Kupperman, D.S., 15:3213
Ho, C. M., Phase decorrelation, streamwise vortices and acoustic radiation in mixing layers, 15:3204 (RA;US)
Ho, K., *See* Min, B.J., 15:2889
Ho, K.M., *See* Takeuchi, N., 15:2877
See Voigtlander, B., 15:2895
Ho, S.K., Quasilinear diffusion modeling of the alpha-loss-cone instability in a tandem-mirror reactor, 15:4381 (J;US)
Ho, Y.H., *See* Shaw, N.M., 15:3970
Hoard, R., *See* Chocol, C., 15:4488
Hobbs, L.W., *See* Rankin, J., 15:2941
Hobbs, R.W., *See* Bretscher, M.M., 15:2489
Hock, S.M., A comparison of results from dynamic-response field tests, 15:2404 (BA;US)
Hodgin, C.R., Development of a hazardous materials dispersion modeling capability with application to ambient air monitoring network design: Project plan, 15:3465 (R;US)
Hoehn, M.V., *See* Oothoudt, M.A., 15:3297
Hoffman, D.J., *See* Caughman, J.B.O. II, 15:4392
Hoffman, H., Horizontal cold source: Fluid dynamics tests on the moderator model in water and air current, 15:2472 (TG;US)
Hoffman, M.A., Advanced fusion MHD power conversion using the CFAR [compact fusion advanced Rankine] cycle concept, 15:4444 (R;US)
See Campbell, R.B., 15:4464
Hoffman, N., *See* Orth, C.D., 15:4475
Hoffmann, E.H., Mechanical design of the Inside Launch system for electron cyclotron heating in DIII-D, 15:4407 (R;US)
Hoffmann, F., *See* Williams, G.P., 15:3283
Hoffmann, G., *See* Theissig, W., 15:2919
Hoffmann, H., Horizontal cold source friction losses of D_2 model with coaxial tubes comparison of calculated values with experimental results in D_2, 15:2259 (TG;US)
Horizontal cold source friction losses of D_2 model with separate tubes comparison of calculated values to experimental results in D_2, 15:2473 (TG;US)
Hoffmann, J., *See* Arnold, F., 15:3350
Hofmann, G., *See* Muller, A., 15:3917
Hogan, R.E., Comparison of a cavity solar receiver numerical model and experimental data, 15:2326 (BA;US)
Hogrefe, R.L., *See* DeLuca, W.H., 15:2574, 15:2582
Hogue, R., *See* Herrera, J., 15:3327
Hohmann, K., Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook, 15:2601 (R;US)
Holcombe, N.T., *See* Williams, M.C., 15:2080
Hole, E.O., Free radical formation in single crystals of 2-deoxyguanosine 5'-monophosphate, and guanine hydrobromide monohydrate after X-irradiation at 10 and 65 K: An ESR, ENDOR and FSE study, 15:3712 (RA;DE)
See Close, D.M., 15:3708
See Nelson, W.H., 15:3716
See Sagstuen, E., 15:3717
Holland, O.W., Enhanced oxidation of $TiSi_2$ films by As^+ implantation, 15:2990 (BA;US)
Hollander, S., Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988, 15:2418 (R;US)
Holley, W.E., *See* Thresher, R., 15:2393
Hollick, R.C., *See* Smith, D.I., 15:3124
Holloran, J.W., Composite ceramic superconducting wires for electric-motor applications. Annual report No. 1, 30 June 1988-30 June 1989, 15:3117 (R;US)
Holloway, J.S., *See* Bott, J.F., 15:3146
Holm, D.D., *See* David, D., 15:4285
Holman, H.Y., *See* Fisk, W.J., 15:2691
Holman, R., *See* Boyanovsky, D., 15:4057
Holmes, C., *See* McGowin, C.R., 15:2078
Holmes, J.A., *See* Spong, D.A., 15:4304
Holmes, M.J., *See* Clark, G.A., 15:2096
Holmgren, J.D., *See* Blinn, M.B., 15:2047
Holmstrom, B.K., Water resources data for Wisconsin, Water Year 1988. Water-data report (Annual), 1 October 1987-30 September 1988, 15:3559 (R;US)
Holoch, R., *See* Bulian, N., 15:3342
Holonyak, N., Semiconductor quantum-well lasers and related optoelectronic devices on silicon, III-V. Technical report, 15:3145 (R;US)
Holstein, P.A., Implosion symmetry and stability, 15:4386 (R;FR)
Holtkamp, D.B., Physics with ultra-low energy antiprotons, 15:4044 (R;US)
Holve, D.J., In situ optical measurements of hydrofluoric acid aerosols, 15:3469 (R;US)
Holz, M., *See* Goltsos, W., 15:3148
Holzer, B., *See* Blum, M., 15:3289
Holzschelter, M.H., *See* Holtkamp, D.B., 15:4044
Homicz, G.F., Effect of turbulence scale on VAWT aerodynamic response, 15:2390 (BA;US)
Hong, Q.Z., *See* Li, J., 15:2882
Hong, R., Beam current regulation of DIII-D neutral beam long pulse ion sources, 15:4415 (R;US)
Hood, M.L., Calculated performance of a "hot-patch" for steady state post dryout experiments, 15:3186 (R;GB)
Hook, T.R., *See* Burkhalter, H.E., 15:4487
Hooper, E.B., MTX [Microwave Tokamak Experiment] diagnostic and auxiliary systems for confinement, transport, and plasma physics studies, 15:4352 (R;US)
Hoover, W.G., Generalization of Nose's isothermal molecular dynamics: Non-Hamiltonian dynamics for the canonical ensemble, 15:4295 (J;US)
Hopkins, D. A., *See* Chamis, C. C., 15:2976
Hopkins, D.A., *See* Chamis, C.C., 15:3248
Hopkins, G.D., *See* Roberts, P.V., 15:3554
Hori, M., *See* Hirano, T., 15:2695
Horie, Tomoyoshi, *See* Tachikawa, Katsuhiro, 15:4424
Horie, Y., Development of an inventory of materials potentially sensitive to ambient atmospheric acidity in the South Coast Air Basin. Final report, 15:3558 (R;US)
Horli, S., *See* Kring, C.T., 15:2170
Horlike, Hiroshi, *See* Matsuoka, Mamoru, 15:4422
Horlke, N., *See* Frank, R., 15:3787
Horn, K., *See* Blum, M., 15:3289
See Duerr, W., 15:3263
Horne, S.F., *See* Kesner, J., 15:4482
Hornung, M., *See* Bulian, N., 15:3342

Horowitz, C.J., Cold nuclear fusion in metallic hydrogen and normal metals, 15:4169 (J;US)
Horton, J.A., *See* McKamey, C.G., 15:2674
Horvath, D., *See* Whitehouse, D.A., 15:3971
Horwich, G., Disasters and market response: An economists perspective on the management of urban emergencies, 15:2593 (R;US)
Hosoya, Akio, (2+1)-dimensional quantum gravity, 15:4287 (R;JP)
Host, G.E., Microcomputer Scientific Software Series 5: The Biomass User's Manual. Forest Service general technical report, 15:2298 (R;US)
Hotchkis, M.A.C., *See* McNeill, J.H., 15:4101
Houlton, R.J., *See* Cooke, D.W., 15:2921, 15:3128
Houpis, J.L.J., Carbohydrate translocation and branch autonomy of Pinus ponderosa, 15:2309 (R;US)
Houser, R.M., *See* Alpert, D.J., 15:2328
Houts, M.G., *See* Asbell-Clarke, J.E., 15:2652
Howard, A.J., *See* Wang, T.F., 15:4082
Howard, C.G., Immobilisation in cement of ion exchange resins arising from the purification of reagents used for the decontamination of reactor circuits. Fourth semestrial report January-June 1988, 15:2175 (R;GB)
Howard, R.L., *See* Chu, B., 15:3231
Howe, M.A., Migration of radio-marked whooping cranes from the Aransas-wood buffalo population: Patterns of habitat use, behavior, and survival. Technical report, 15:2602 (R;US)
Howell, R.B., *See* Park, H.K., 15:4350
Howell, R.J., *See* Wachs, A.L., 15:4258
Howell, S.G., Waste-minimization insights for the polymer industry, 15:2742 (R;US)
Hrubesh, L.W., Studies of polymer foam morphology with FIR [far-infrared radiation] laser scattering, 15:2987 (R;US)
Hsieh, E.J., Effects of nitrogen pulsing on sputter-deposited beryllium films, 15:2855 (R;US)
Hsieh, K.C., *See* Holonyak, N., 15:3145
Hsuan , H., *See* Park, H.K., 15:4350
Hsue, S.-T., Measurements of plutonium residues from recovery processes, 15:2246 (R;US)
Hsueh, J.K., *See* Chen, C.C., 15:2559
Hu, H.H., Stability of core-annular flow in a rotating pipe, 15:3941 (J;US)
Huang Pa., *See* Winter, K., 15:3762
Huang, J., *See* Robertson, D.W., 15:4520
Huang, J.Y., *See* Superfine, R., 15:4234
Hubbard, L.M., *See* Dudney, C.S., 15:2693
Hubbell, J.M., *See* McElroy, D.L., 15:2186
Hucka, V.J., Methane drainage from gassy Western US coal seams, 15:2083 (R;US)
Hudnell, H.K., *See* Otto, D.A., 15:3780
Hudson, D.B., *See* Wierenga, P.J., 15:2218
Hudson, D.V., *See* Berson, A.E., 15:3610
Huebel, K., Accumulation of radionuclides in fish during specified normal operation of nuclear installations and after incidents. Annual report 1987, 15:3567 (R;DE;In German)
Huefner, J., *See* Aichelin, J., 15:3993
See Kurihara, Y., 15:3994
Huenemohr, H., Thick-target ^{21}Ne yield of the reaction $^{18}O(\alpha,n)^{21}Ne$ in the range 4.0-8.8 MeV, 15:4078 (RA;DE;In German)
Huepper, A., *See* Harney, H.L., 15:4148
Huettermann, J., Free radicals from solid oriented DNA-fibers: Facts and fancy, 15:3709 (RA;DE)
See Sieber, K., 15:3713
See Zell, I., 15:3734
Huff, D.A., *See* Joyce, J.P., 15:2650, 15:2651
Huffaker, R.C., *See* Thomson, W.W., 15:3601
Hughers, T.J.R., *See* Franca, L.P., 15:3193
Hughes, R.J., *See* Holtkamp, D.B., 15:4044
Hughes, W.M., *See* Loree, T.R., 15:3179
Hui, T.E., *See* Fisher, D.R., 15:3748
Huizenga, J.R., *See* Toke, J., 15:4168
See Wile, J.L., 15:4100
Hulbert, L., *See* Cassady, M., 15:2150
Hulet, E.K., Results from heavy-ion bombardments of ^{254}Es, 15:4122 (R;US)
Hull, J.R., Maintenance of brine transparency in salinity gradient solar ponds, 15:2349 (BA;US)
Hulse, C.O., Development of a high temperature thin film static strain gage, 15:3367 (RA;US)
Hunklinger, S., *See* Behar, M., 15:4227
Hunn, B.D., *See* Pletzer, R.K., 15:2694
Hunt, J.G., Aspects of radiological protection in nuclear installations, 15:4187 (R;BR;In Portuguese)
Hunt, J.T., *See* Christie, D.J., 15:4442
Hunt, W.A., Effects of iron particles on behavior and brain function: Initial studies, 15:3756 (R;US)
Hussain, F., *See* Stanaway, S., 15:3205
Hussin bin Mohd Nor, Synthesis of acrylic prepolymer, 15:2983 (R;MY)
Synthesis of epoxidised soya bean oil acrylate, 15:2984 (R;MY)
See Dahlan bin Haji Mohd, 15:2255
See Mohamad Hilmi bin Mahmood, 15:3080
Hustrulid, W.A., *See* Ubbes, W.F., 15:2237
Hutton, J.T., *See* Alexander, D.J., 15:4397
See Nanstad, R.K., 15:3215
Huusko, A., Ecological aspects of lake regulation in northern Finland. Part 4. Spawning and the survival of the young fish, 15:2289 (R;FI;In Finnish)
See Alasaarela, E., 15:2290
Huyler, N.K., Fuel-supply structure of wood-fired power plants in the Northeast: Loggers' perspective. Forest Service research paper, 15:2273 (R;US)
Hwa, R.C., Average transverse momentum in the geometrical branching model with jets, 15:3979 (R;US)
Intermittency in multiparticle dynamics, 15:3981 (R;US)
Towards a unification of the geometrical, stochastic and dynamical properties of hadronic matter in collision, 15:3980 (R;US)
Hwang, Y., Analytic solution of pseudocolloid migration in fractured rock, 15:2212 (R;US)
Mass transport in salt repositories: Transient diffusion into interbeds, 15:2206 (R;US)
Mass transport in salt repositories: Steady-state transport through interbeds, 15:2207 (R;US)
Hyakutake, Mikio, *See* Koori, Norihiko, 15:4427
Hyde, W.T., Comparison of GCM and energy balance model simulations of seasonal temperature changes over the past 18 000 years, 15:3399 (J;US)
Hylton, L.D., Turbine airfoil film cooling, 15:3202 (RA;US)
Hyvaerinen, T., *See* Aho, V.J., 15:2087

I

Ibach, H., *See* Voigtlander, B., 15:2895
Ibaek Jensen, P., *See* Dam-Johansen, K., 15:3419
Ichiguchi, K., *See* Nakamura, Y., 15:4346
Idemitsu, Kazuya, Plutonium diffusivity in compacted bentonite, 15:2223 (R;JP)
Iglehart, D.L., *See* Glynn, P.W., 15:4502
Ihas, G.G., Quantum fluids and solids, 1989, 15:3938 (B;US)
Ihizuka, Takayuki, *See* Shimomura, Hiroaki, 15:2454
Ihle, G., *See* Pirner, H.J., 15:4001
Iida, Akihide, *See* Koori, Norihiko, 15:4427
Iida, Shinji, *See* Sakata, Fumihiko, 15:4152
Iijima, Shungo, *See* Yamamuro, Nobuhiro, 15:4157
Ikeda, Yasushi, Studies and applications of neutron radiography with film methods, 15:2251 (RA;JP;In Japanese)
Il'in, N.V., *See* Korytova, L.I., 15:3645
Ilgenfritz, M., *See* Pirner, H.J., 15:4000
Imai, Hisashi, *See* Matsuo, Hideto, 15:2491
Imai, T., High efficiency LHCD experiments on JT-60, 15:4417 (RA;JP)
Imlay, R., *See* Chan, Lai-Him, 15:3944
Inagaki, Toru, *See* Hale, P.D., 15:3600
Ingalls, M.N., Measurement of on-road vehicle emission factors in the California South Coast Air Basin. Volume 1. Regulated emissions. Final report, 15:2796 (R;US)
Ingham, H., *See* Friend, D.G., 15:2151

Innes, D., Early phase of supernova remnant evolution, 15:3822 (RA;DE;In German)
Inokuti, M., *See* Kimura, M., 15:3908
Inoue, T., Comparison of H^{minus} and D^{minus} production in a magnetically filtered multicusp source, 15:4439 (R;US)
Inyakin, A.V., *See* Alde, D., 15:3969
Iracane, D., *See* Chaix, P., 15:4507
Irving, P., *See* Jacobson, J., 15:3404
Isaacs, H.S., *See* Davenport, A.J., 15:2903
Isaev, I.G., Prospects for development of radiotherapy of patients with esophagus cancer (role of modifying factors), 15:3643 (RA;SU;In Russian)
Ishida, Shinichi, *See* Ozeki, Takahisa, 15:4425
Ishida, Takanobu, Stable isotope studies: Progress report, October 1988–October 1989, 15:3075 (R;US)
Ishiguro, Katsuhiko, *See* Idemitsu, Kazuya, 15:2223
Ishii, M, Interfacial area in two-phase flow, 15:3187 (R;US)
Ishii, Takeshi, *See* Hiraoka, Toru, 15:2462
Islam, M.M., Nuclear power technical co-operation in the Republic of Korea, 15:2617 (J;XA)
See Haller, K., 15:3942
Itami, Kiyoshi, *See* Ozeki, Takahisa, 15:4425
Itoh, Hisayoshi, 1MeV-electron irradiation induced defects in epitaxially grown 3C-SiC, 15:2920 (R;JP)
Itoh, K., Comment on ICRF current drive in reactor grade tokamak, 15:4332 (RA;JP)
Effect of loss cone on confinement in toroidal helical device, 15:4348 (R;JP)
See Kishimoto, Y., 15:4334
Itoh, Nobuo, *See* Baba, Mamoru, 15:4119
Itoh, S., Steady state current drive by lower hybrid wave in TRIAM-1M, 15:4418 (RA;JP)
See Itoh, K., 15:4332
See Kishimoto, Y., 15:4334
Itoh, S.-I., *See* Itoh, K., 15:4348
Itoyama, H., Quantum groups, braiding matrices and coset models, 15:4034 (R;US)
Ittermann, B., *See* Sulzer, G., 15:4228
Iwai, Takashi, *See* Arai, Yasuo, 15:2461
See Ogawa, Toru, 15:2838
Iwase, Akihiro, Effect of electron-excitation on radiation damage in ion-irradiated FCC metals, 15:4230 (R;JP;In Japanese)
Izaki, Yoshiyuki, *See* Watanabe, Takao, 15:2656
Izatt, R.M., Determination of thermodynamic data for modeling corrosion: Volume 1, Sulfates (Revision 1): Final report, 15:2443 (R;US)
Determination of thermodynamic data for modeling corrosion: Final report, Volume 2: Chlorides and acetates, 15:2444 (R;US)
Izotova, I.A., *See* Firsova, P.P., 15:3655

J

Jaafar bin Abdullah, *See* Yahaya bin Jafar, 15:2257
Jaanimagi, P., *See* Kessler, T.J., 15:4370
Jaber, M.R.A., *See* Linkous, C.A., 15:3071
Jackiw, R., *See* Deser, S., 15:4049
Jackson, A., The challenges of third-generation synchrotron light source, 15:3265 (R;US)
Jackson, B., *See* Cruz, A.J., 15:4243
Jackson, E.L., *See* Culik, J.S., 15:2302
Jackson, K.J., *See* Worlery, T.J., 15:2238
Jackson, M., EPA (Environmental Protection Agency) programs and the regulation of carcinogens: Methods and philosophies. Technical report, 15:3786 (R;US)
Jackson, S., *See* Wong, I., 15:3807
Jackson, T.L., Evolution of reaction center in an explosive material, 15:3106 (R;US)
Jacobs, V.L., *See* Brown, C.M., 15:3925
Jacobson, J., A collaborative effort to model plant response to acidic rain, 15:3404 (R;US)
Jacobus, M.J., Loss-of-coolant accident (LOCA) testing of aged cables for nuclear plant life extension, 15:2476 (R;US)
Jaeger, E., *See* Sulzer, G., 15:4228
Jaensch, H., *See* Korsch, W., 15:3322
See Reich, H., 15:3290
Jaeschke, E., *See* Duerr, W., 15:3263
Jaffe, R.L., Bound states of the Dirac equation outside a hard sphere, 15:4290 (J;US)
Jahan, M.S., *See* Cooke, D.W., 15:2921, 15:4256
Jakobsen, J., *See* Andersen, B., 15:2380
Jalbert, R.A., *See* Longhurst, G.R., 15:4406
James, R.B., Nonlinear absorption of CO_2 laser radiation in *p*-type InSb, 15:3177 (J;US)
Jameson, R.A., Applications of RF linacs to free-electron lasers and particle beams, 15:3312 (J;US)
Jank-Raff, A., *See* Huebel, K., 15:3567
Jannson, T., *See* Moslehi, B., 15:3373
Janot, C., *See* Ma, Y., 15:2894
Janowitz, G.S., *See* Vukovich, F.M., 15:2128
Jansch, H., *See* Becker, K., 15:4097
Janson, L.E., Quality control and requirements for corona heated HDPE casing for district heating pipelines, 15:2779 (R;SE;In Swedish)
Janssens, R.V.F., *See* Moore, E.F., 15:4107
Jansson, C., *See* Vessely, V., 15:3467
Jaques, P., *See* Colome, S.D., 15:3447
Jarabek, A.M., *See* Overton, J.H., 15:3783
Jardin, S.C., *See* Pillsbury, R.D. Jr., 15:4474
See Sayer, R.O., 15:4301
See Strickler, D.J., 15:4391
Jauhiainen, J., Alternative development programme of the projects concerning the building management control, 15:2682 (R;FI;In Finnish)
Jayaraman, N., *See* Stouffer, D.C., 15:2842
Jayaswal, B., *See* Sankaran, A.V., 15:3505
Jbeli, H., Elementary analysis by means of the x fluorescence and energy dispersion, 15:3066 (R;FR;In French)
Jean, Y.C., *See* Wachs, A.L., 15:4258
Jefferson, J.W., *See* Anderson, T.D., 15:2610
Jeffries, W., *See* Manwell, J.F., 15:2400
See Stein, W., 15:2399
Jellinek, J., Generalization of Nose's isothermal molecular dynamics: Necessary and sufficient conditions of dynamical simulations of statistical ensembles, 15:4297 (J;US)
Jellison, G.E. Jr., A simple implementation of a power supply for constant phototube current in light modulation spectroscopy, 15:3376 (J;US)
See Darken, L.S., 15:3012
Jenkins, J.T., *See* Louge, M.Y., 15:2084
Jenkins, M.G., Numerical and empirical verification of the stress state in a ceramic, button-head, tensile specimen, 15:2913 (R;US)
Jennison, D.R., *See* Stechel, E.B., 15:4260
Jensen, D.R., *See* Fischer, G.E., 15:3309
Jensen, R.A., Gene-enzyme relationships in somatic cells and their organismal derivatives in higher plants: Progress report, August 1, 1988–July 31, 1989, 15:3602 (R;US)
Jensen, S.A., Power mesurements on a 99 kW "Smedemoelle" wind turbine, erected at Hasle, Bornholm, 15:2385 (R;DK;In Danish)
Jenssen, H.P., *See* Ohana, I., 15:2937
Jeppesen, B., CROSS SECTION. Program description and user manual, 15:3137 (R;DK)
Jerman, G., *See* German, R.M., 15:2808
Jernigan, T.C., *See* Gouge, M.J., 15:4388
Jervis, T.R., Excimer laser mixing of titanium layers on AISI 304 stainless steel, 15:2866 (BA;US)
Jessberger, E.K., *See* Bednar, F., 15:3351
See Kissel, J., 15:3348, 15:3349
Jha, M.C., *See* Boysen, J.E., 15:2017
Jiang, M.F., Single-particle spectrum and ring-diagram nuclear matter calculations: A reply to a Comment, 15:4174 (J;US)
Jimbo, Kouichi, Investigation of boundary for the negative ion extraction in the sheet-plasma negative ion source, 15:4349 (R;JP)
Jimenez-Gonzalez, H., *See* Withrow, S.P., 15:2994
Jimenez-Mier, J., Partial and total cross sections and multiplet structure in the photoionization of atomic manganese, 15:3923 (J;US)
John, R., *See* Wefers, H., 15:3803

John, R.W., Building management systems: user experiences, 15:2662 (R;GB)
Johnson, A.M., *See* Grenich, A.F., 15:2781
Johnson, B.K., Space heating performance of the ghost ranch sundwellings, 15:2334 (BA;US)
Johnson, B.V., *See* Hajek, T.J., 15:3201
Johnson, D.J., *See* Ruiz, C.L., 15:3311
Johnson, D.L., *See* Millar, J.D., 15:3684
Johnson, D.W., *See* Park, H.K., 15:4350
Johnson, E.C., *See* Whitfield, R.G., 15:4505
Johnson, J.A., *See* Garcia, G.V., 15:2834
Johnson, J.L., *See* Nakamura, Y., 15:4346
Johnson, J.T., *See* Moss, R.D., 15:2413
Johnson, K.I., A sensitivity study of near-field thermomechanical conditions in tuff, 15:2227 (R;US)
Johnson, L., *See* Jackson, M., 15:3786
Johnson, L.C., *See* Park, H.K., 15:4350
Johnson, L.D., Trial burns: methods perspective, 15:2763 (R;US)
Johnson, L.K., Absolute differential cross sections for small-angle H^+-He direct and charge-transfer scattering at keV energies, 15:3918 (J;US)
Johnson, R., Computer controlled MHD power consolidation and pulse-generation system: Technical progress report, October 1988–March 1989, 15:2648 (R;US)
Johnson, R.A., Analytic embedded atom method model for bcc metals, 15:2876 (J;US)
Johnson, R.W., Simulations of local Nusselt number using an algebraic stress model (ASM) for turbulent flow in a square 180 degree bend, 15:3937 (R;US)
Johnson, S.M., Processing and fabrication of high-temperature oxide superconductors. Annual report, 1 August 1988-30 June 1989, 15:2897 (R;US)
Johnson, T.M., *See* Loree, T.R., 15:3179
Johnsson, F., Heat transfer in circulating fluidized bed boilers, 15:2101 (R;SE)
Johnston, W.E., *See* Robertson, D.W., 15:4520
Jokipii, J.R., Galactic cosmic rays in three dimensions, 15:3865 (RA;US)
See Mewaldt, R.A., 15:3852
Jolley, J.G., *See* Gianotto, A.K., 15:2832
Jolliffe, C.B., *See* Howard, C.G., 15:2175
Jonas, D.M., *See* Chen, Y., 15:3084
Jones, D.V.C., Management of tritium wastes in the United Kingdom. A survey of present and future arisings, review of possible disposal options and areas where further R and D may be needed to develop a management strategy for the future, 15:2179 (R;GB)
Jones, E., Training waste generators: The first responder in proper waste management, 15:2184 (R;US)
Jones, G.D.D., *See* Cullis, P.M., 15:3711
Jones, J.E., *See* Rosocha, L.A., 15:4453
Jones, J.W., *See* Pletzer, R.K., 15:2694
Jones, L., *See* Berlow, J.R., 15:2773
Jones, L.G., *See* Capone, R.L., 15:2430
Jones, M., Information on substances for review as toxic air contaminants. Summary report, January 1984-February 1989 (Final), 15:3430 (R;US)
See Stein, W., 15:2399
Jones, M.E., *See* Wilks, S.C., 15:3279
Jones, P.D., The effect of urban warming on the Northern Hemisphere temperature average, 15:3397 (J;US)
Jones, P.L., *See* Young, C.E., 15:4209
Jones, R.G., *See* Rosocha, L.A., 15:4453
Jones, R.H., *See* Freisel, M.A., 15:2849
Jordan, E.H., *See* Walker, K.P., 15:2843
Jorgensen, J.D., Electronically focused time-of-flight powder diffractometers at the Intense Pulsed Neutron Source, 15:3358 (J;DK)
See Beno, M.A., 15:4249
See Egami, T., 15:2905
See Zhang, K., 15:4250
Joseph, D.D., Lubricated pipelining: Stability of core-annular flow, 15:2134 (R;US)
See Hu, H.H., 15:3941
Joseph, J.A., *See* Hunt, W.A., 15:3756
Joshi, C., *See* Umstadter, D., 15:4353
Joslyn, H.D., *See* Dring, R.P., 15:3199
Jotaki, E., *See* Itoh, S., 15:4418
Joyce, J.P., Interagency Nuclear Safety Review Panel: Safety evaluation report for Galileo: Volume 2, 15:2651 (R;US)
Safety evaluation report for Galileo: Volume 1, 15:2650 (R;US)
Jozewicz, W., Bench-scale evaluation of calcium sorbents for acid-gas emission control. Report for October 1988-March 1989, 15:3444 (R;US)
Calcination of calcium hydroxide sorbent in the presence of SO_2 and its effect on reactivity. Report for October 1988-March 1989, 15:3443 (R;US)
Judkins, R.R., *See* Keiser, J.R., 15:2018
Jung, E., *See* Schuessler, H., 15:3729
Jusko, M.J., *See* Whitfield, R.G., 15:4505
Jutson, J.A., Role of $Fe_xCr_{2-x}O_3$ standard solid solutions in the identification of rhombohedral phase composition by XRD, 15:2815 (R;GB)
Juutinen, Sakari., Transfer reactions with very heavy ions. Quarterly report 3. quarter 1987, 15:4106 (R;FI)

K

Kabuss, E.M., *See* Alberich, T., 15:3956
Kachanov, V.A., *See* Alde, D., 15:3969
Kachelmyer, A.L., Noise levels in a tunable CO_2 laser source, 15:3147 (R;US)
Kachkachi, M., N=2 supergravity in superspace and the BRS symmetry, 15:4276 (R;XA)
Kadish, A., Fields and flows in diffusing ionospheric plasmas, 15:4362 (BA;US)
Kado, N.Y., *See* Colome, S.D., 15:3447
Kaether, D., *See* Burkert, E., 15:3347
Kagan, L.F. and others, *See* Risin, S.A., 15:3652
Kaganskij, V.L., *See* Simbirtseva, L.P., 15:3654
Kagiya, V.T., A physicochemical aspects of radioprotection and sensitized cancer radiotherapy, 15:3707 (RA;DE)
Kahl, J., *See* Fleckenstein, T., 15:2028
Kahn, E.P., Evaluation methods in competitive bidding for electric power: Volume 2, Technical appendix, 15:2635 (R;US)
Kai, K., Heat capacities of LaD_x and LaH_x ($1.9 \leq x \leq 3.0$) from 1 to 300 K, 15:2955 (J;US)
Kaiser, J.H., *See* Wachs, A.L., 15:4258
Kaisler, K.L., *See* Joyce, J.P., 15:2650, 15:2651
Kalem, S., *See* Maruyama, T., 15:3015
Kalia, R.K., Dynamic simulation of mixed quantum-classical systems, 15:4208 (R;US)
See Degani, M.H., 15:2910
Kalinich, J.F., Effect of gamma radiation on DNA methylation, 15:3690 (R;US)
Kalinowski, J., *See* Grzadkowski, B., 15:4024
Kallio, P., *See* Kerfoot, W.B., 15:3573
Kallio, P.E., *See* Ketchum, B.H., 15:3574
Kam, F.B.K., Power reactor embrittlement data base, 15:2510 (R;US)
Kamath, V.A., Development of a reservoir simulation for thermal recovery of heavy oils/tar sands in the presence of gas hydrates: Final report, 15:2156 (R;US)
Kamel, R.S., Quality control scheme for thyroid related hormones measured by radioimmunoassay. Final report for the period 1 January 1985 - 1 April 1989, 15:3620 (R;XA)
Kamide, Y., *See* Ahn, B., 15:3882
Kamimura, Masayasu, *See* Koori, Norihiko, 15:4427
Kaminska, M., *See* Khachaturyan, K., 15:3029
Kammerer, P.A., *See* Holmstrom, B.K., 15:3559
Kammuri, Tetsuo., *See* Kinouchi, Shin-ichi, 15:4153, 15:4154
Kampp Rasmussen, N.B., Note on improved k-ϵ turbulent flow model, 15:3111 (RA;DK;In Danish)
Numerical integration method of radiative exchange (NIMREX), 15:3113 (RA;DK)
User manual and program documentation for the "TUFCA" flow program, 15:3112 (RA;DK;In Danish)
See Olsen, A., 15:3110
Kan, X.B., Comment on "Speckle in the diffraction patterns of Hendricks-Teller and icosahedral glass models", 15:4241 (J;US)

Kandler, H., *See* Duerr, W., 15:3263
Kandybo, A.A., *See* Sel'khov, Yu.I., 15:3631
Kane, G.L., How to study longitudinal *W*s in the TeV region, 15:4012 (J;US)
See Gunion, J.F., 15:4059
Kang, M., *See* Rosocha, L.A., 15:4453
Kang, T.W., *See* Boysen, J.E., 15:2017
Kankelelt, E., *See* Schwartz, B., 15:4116
Kannan, V., *See* Nambi, K.S.V., 15:4183
Kanter, E.P., *See* Belkacem, A., 15:4210
Kantola, L., *See* Tikkanen, P., 15:2288
Kantzos, P., Fatigue crack growth study of SCS6/Ti-15-3 composite, 15:2974 (R;US)
Kao, Y.H., *See* Woronick, S.C., 15:3018
Kaplia, A.K., *See* Jackson, T.L., 15:3106
Kaplan, B., Solution bias in complex systems modeling, 15:4514 (R;US)
Kaplan, S.N., *See* Fujieda, I., 15:3354
Kapusta, J., Contribution of two-pion annihilation to dilepton emission from proton-nucleon collisions, 15:4008 (J;US)
Karan, Hiroko I., *See* Hale, P.D., 15:3600
Karasaki, K., *See* Majer, E.L., 15:3812
Karasulu, M., *See* Van Tuyle, G.J., 15:2496
Karge, H.G., Investigation of the formation and chemical aspects of coke deposits occurring on acid, monofunctional zeolite catalysts through typical reactions with hydrocarbons, 15:2270 (R;DE;In German)
Karjalainen, J., *See* Huusko, A., 15:2289
Karki, K.C., Aerothermal modeling program. Phase 2, element A: improved numerical methods for turbulent viscous recirculating flows, 15:3196 (RA;US)
Karl, T., *See* Jones, P.D., 15:3397
Karlsson, B., MINTOP industrial load management system, 15:2637 (R;SE;In Swedish)
Karpuk, M., *See* Copeland, R.J., 15:2267
Kasai, Hidekazu, *See* Watanabe, Takao, 15:2656
Kaschner, R., *See* Ziesche, P., 15:4220
Kasinski, J.J., Optical generation of coherent surface acoustic waves: A new probe of surface dynamics and structure, 15:4238 (J;US)
Kassner, M.E., Evaluation and thermodynamic analysis of phase equilibria in the U-Al system, 15:2869 (J;NL)
Kataja, M., Hadronization of the flux tubes in ultrarelativistic nucleus–nucleus collisions, 15:4167 (J;US)
Kataja, Markku., Hydrodynamics in high-energy nuclear collisions. Quarterly report 3. quarter 1987, 15:4004 (R;FI)
Katsouleas, T., *See* Wilks, S.C., 15:3279
Katz, N., *See* Zukerman-Schpector, J., 15:4222
Katz, R., Theory of RBE: Annual progress report, January 1, 1989–December 31, 1989, 15:3617 (R;US)
Kaufherr, N., Chemical cleaning of aluminum alloy surfaces for use as vacuum materials in synchrotron light sources, 15:2818 (R;US)
Kaufman, R.M., *See* Hylton, L.D., 15:3202
Kaul, R.K., Level-one SU(3) Wess-Zumino model on higher genus Riemann surfaces, 15:4036 (R;XA)
Kaup, D.J., Electron plasma interactions in crossed fields, 15:4361 (BA;US)
Kauppi, A., Evaluation of the thermal performance of the building envelope of existing buildings, 15:2707 (R;FI;In Finnish)
Kauppi, M., *See* Paajala, J., 15:2073
Kawagoe, M., *See* Sato, T., 15:2786
Kawai, M., Semiclassical distorted wave theory of inclusive nucleon inelastic scattering to continuum, 15:4165 (RA;JP;In Japanese)
Kawaji, Satoshi, *See* Shimomura, Hiroaki, 15:2454
Kawakami, H., *See* Kring, C.T., 15:2170
Kawasaki, Kouzo., *See* Hiratsuka, Hajime, 15:4423
Kawasaki, S., *See* Itoh, S., 15:4418
Kay, B.D., The influence of adsorbate–absorbate hydrogen bonding in molecular chemisorption: NH_3, HF, and H_2O on Au(111), 15:3094 (J;US)
Kaye, S.M., *See* Riedel, K.S., 15:4305
Kayser, J., *See* Baumann, H., 15:2254, 15:3291, 15:3292
Kazimi, M.S., *See* Brereton, S.J., 15:4462
Keane, C., *See* Naccach, D., 15:4369
Keane, J., *See* Mortazavi, P., 15:3284
Kearsey, A., *See* Bond, R.D., 15:2176
Keaton, P.W., *See* Asbell-Clarke, J.E., 15:2652
Kebede, A., *See* Cooke, D.W., 15:4256
Keck, R.L., *See* Marshall, F.J., 15:4484
Kehs, R.A., *See* Bromborsky, A., 15:4182
Kell, M., *See* Zhao, G., 15:2892
Keiser, J.R., Chlorine related degradation of materials in coal liquefaction, 15:2018 (R;US)
Kelleher, W.P., Optimization of the testing volumes with respect to neutron flux levels in the two-target high flux D-Li neutron source for the international fusion materials irradiation facility, 15:4435 (R;US)
Keller, E., *See* Faber, P.M., 15:3538
Keller, H., *See* Klems, J.H., 15:2343
Keller, J.F., Applicable or relevant and appropriate requirements (ARARs) for radioactive mixed waste, 15:2228 (R;US)
Regulatory requirements for groundwater monitoring networks at hazardous waste sites, 15:3501 (R;US)
See Geffen, C.A., 15:2243
Keller, K., *See* Bellm, D., 15:4086
Keller, R., *See* Leung, K.N., 15:3304
Keller, R.A., *See* Fearey, B.L., 15:3905
Kelley, M.H., *See* McClelland, J.J., 15:3909
Kelley, N.D., An initial look at the dynamics of the microscale flow field within a large wind farm in response to variations in the natural inflow, 15:2384 (R;US)
Kelley, R., *See* Combs, J., 15:3580
Kellman, D., *See* Hong, R., 15:4415
Kelly, J., *See* Jackson, M., 15:3786
Kelly, M.J., *See* Knapp, J.A., 15:2853
Kelly, P.M., *See* Jones, P.D., 15:3397
Kemmer, J., *See* Behar, M., 15:4227
Kenik, E.A., *See* Godbole, M.J., 15:2878
Kenkre, V.M., *See* Grigolini, P., 15:4246
Kennedy, J.B., *See* Mcvey, J.B., 15:3198
Kennett, R.J., *See* Van Tuyle, G.J., 15:2546
Kennington, J.L., Optimization algorithms for new computer architectures with applications to personnel-assignment models. Annual report (Final), 1 May 1988-30 April 1989, 15:4501 (R;US)
Kenski, D.M., *See* Streets, D.G., 15:3408
Kenton, M.A., *See* Sharon, A., 15:2517
Kephart, R.D., *See* Fast, R.W., 15:3333
Keraenen, R., *See* Hellsten, S., 15:2287
Kerfoot, W.B., Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report, 15:3573 (R;US)
Kerman, A.K., Variational calculations in gauge theories, 15:4051 (J;US)
Kern, K., *See* Hall, B., 15:2888
Kerns, J.A., High-field superconducting solenoids for the TIBER II PF system, 15:4472 (BA;US)
See Shen, S.S., 15:4446
See Summers, L.T., 15:4473
Kesner, J., Cusp-stabilized mirror-based neutron source, 15:4482 (J;US)
See Luckhardt, S.C., 15:4323
Kessler, T., *See* Marshall, F.J., 15:4484
See Skupsky, S., 15:3184
Kessler, T.J., Broadband phase conversion of the frequency tripled Omega laser, 15:4370 (BA;US)
Ketchum, B.H., Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report, 15:3574 (R;US)
See Kerfoot, W.B., 15:3573
Ketoff, A., Residential energy demand in the six OCED countries: Historic trends and future directions, 15:2646 (R;US)
Keung, W., *See* Barger, V., 15:4014
Kewish, R.W. Jr., Quality assurance and quality control for the compact physics research facility (CPRF) and ZTH experiment, 15:4431 (R;US)
Keyes, B., *See* Olson, J.M., 15:3005

Khachaturyan, K., Lattice relaxation of *DX*-like donors in $Zn_xCd_{1-x}Te$, 15:3029 (J;US)
Khachaturyan, K.A., Magnetic studies of persistent photoconductivity in *n*-$Al_xGa_{1-x}As$, 15:3010 (J;US)
Khadilkar, C.S., *See* Sacks, M.D., 15:2942
Khalil, M.A.K., *See* Rasmussen, R.A., 15:3411
Khan, F., *See* Khandelwal, G.S., 15:4163
Khan, M.R., Apparatus for direct measurement of ash fusion and sintering behavior at elevated temperatures and pressures, 15:2066 (J;US)
Khan, S., ^{4}He(e,e'c) coincidence experiments for investigation of charge symmetry in ^{4}He, 15:4072 (RA;DE;In German)
Direct decay of giant resonances in medium-heavy nuclei, 15:4089 (RA;DE;In German)
Systematics of neutron single particle energies for $16 \leq A \leq 50$, 15:4135 (RA;DE;In German)
The interference term between nuclear charge and nuclear current matrix elements of the E1 giant resonance in ^{12}C and ^{58}Ni, 15:4075 (RA;DE;In German)
Time of flight measurements at the pulsed proton beam, 15:4076 (RA;DE;In German)
Khandelwal, G.S., Nuclear fragmentation energy and momentum transfer distributions in relativistic heavy-ion collisions. Progress report, period ended 30 June 1989, 15:4163 (R;US)
Khaustov, G.V., *See* Alde, D., 15:3969
Khavinson, V.Kh., *See* Nikolaeva, D.V., 15:3663
Khoo, T.L., *See* Moore, E.F., 15:4107
Khoromsky, B.N., *See* Zhidkov, E.P., 15:4518
Khosla, H.S., Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)
Kibbler, A.E., *See* Olson, J.M., 15:3005
Kidder, J.S., *See* Deck, J.W., 15:2419
Kihm, T., *See* Khan, S., 15:4072, 15:4075, 15:4076, 15:4089, 15:4135
See Weber, T., 15:4113
Kiko, J., Meteorite tracking network, 15:4151 (RA;DE;In German)
See Burkert, E., 15:3347
See Wunderlich, R., 15:3295
Kikuchi, M., Plasma conductivity related to bootstrap current on JT-60, 15:4333 (RA;JP)
Kim, C.-L., Variable temperature effects on release rates of readily soluble nuclides: Revision, 15:2205 (R;US)
Kim, F.P., *See* Goldobenko, G.V., 15:3666
See Isaev, I.G., 15:3643
Kim, G.H., *See* Cho, M.H., 15:4364
Kim, H., An investigation of coal-oil reaction pathways using model compounds, 15:2049 (B;US)
Kim, Hyoun-Ee, Effect of gaseous corrosion on the strength of SiC and Si_3N_4, 15:2912 (R;US)
Kim, J., *See* Hong, R., 15:4415
Kim, J.H., Heat transfer, 15:2805 (B;US)
Kim, K., *See* Hyde, W.T., 15:3399
Kim, K.S., Elevated temperature crack growth, 15:3246 (RA;US)
Kim, S., *See* Morsi, B.I., 15:2015
Kim, S.H., *See* Thompson, K.M., 15:3317
Kim, Y.K., *See* Shaw, N.M., 15:3970
Kimura, M., Electron degradation and yields of initial products. VI. Energy spectra of subexcitation electrons in argon and molecular hydrogen, 15:3908 (J;US)
See Johnson, L.K., 15:3918
See Matsumoto, S., 15:2795
See Zygelman, B., 15:3913
King, J.S., *See* Summerfield, G.C., 15:4203
King, M.A., *See* Sebo, D.E., 15:2482
King, W.E., *See* Dominguez-Rodriguez, A., 15:2902
Kinney, E.R., *See* Oothoudt, M.A., 15:3297
Kinnison, D.E., *See* Wuebbles, D.J., 15:3394
Kinoshita, Kim, Technology Base Research Project for electrochemical energy storage: Annual report for 1988, 15:2578 (R;US)
Kinouchi, Shin-ichi, Nuclear collective rotation in the SU_3 model, 2. Quantal rotation for a triaxial configuration, 15:4153 (R;JP)
Nuclear collective rotation in the SU_3 model, 3. Quantal rotation for an axially symmetric configuration, 15:4154 (R;JP)
Kinsey, J.L., *See* Chen, Y., 15:3084
Kirchgessner, D.A., *See* Jozewicz, W., 15:3443
Kirchhoff, R., *See* Manwell, J.F., 15:2400
Kiritsis, E.B., Fuchsian differential equations for characters on the torus: A classification, 15:4026 (J;NL)
Kirk, M.A., *See* Bench, M.W., 15:2991
Kirkland, J., *See* Yang, X.Q., 15:3035
Kirksey, R.E., *See* Ingalls, M.N., 15:2796
Kirkwood, R., *See* Luckhardt, S.C., 15:4323
Kirsten, T., *See* Burkert, E., 15:3347
See Kiko, J., 15:4151
See Wunderlich, R., 15:3295
Kirvel, R.D., *See* Burnham, A.K., 15:4355
Kiseleva, E.S., Individualization of preoperative radiotherapy in esophagus cancer, 15:3644 (RA;SU;In Russian)
See Chissov, V.I., 15:3657
Kishimoto, Teruo, *See* Kinouchi, Shin-ichi, 15:4153, 15:4154
Kishimoto, Y., Effect of electron spatial diffusion on current drive, 15:4334 (RA;JP)
See Itoh, K., 15:4332
Kishimoto, Yasuaki, 1-dimensional single-mode nonlinear FEL amplification code. User's manual, 15:4339 (R;JP;In Japanese)
Energy conversion efficiency in high current Raman regime free electron laser (FEL), 1. Single mode analysis, 15:4341 (R;JP)
Kissel, J., Analysis of surface composition of a Martian moon with the instrument LIMA-D onboard the Mars mission PHOBOS, 15:3349 (RA;DE;In German)
CoMA, an instrument for the detailed in-situ analysis of collected cometary particulates, 15:3348 (RA;DE;In German)
See Vollmer, E., 15:3352
Kivelson, S.A., *See* Emery, V.J., 15:2904
Kizakevich, P.N., *See* Benignus, V.A., 15:3755
Klabucar, D., Phenomenological hadron form factors and finite size of chiral solitons, 15:3999 (RA;DE)
Soliton baryons and Goldstone mesons in the cell model of the QCD vacuum, 15:3997 (RA;DE)
See Hansson, T.H., 15:3998
Klaes, J., *See* Steffens, W., 15:3506
Klapdor, H.V., Max-Planck-Institute for Nuclear Physics. Annual report 1987, 15:4065 (R;DE;In German)
See Bender, E., 15:4139
See Muto, K., 15:4137, 15:4138
See Piepke, A., 15:4104
Klapetzky, A.J., *See* Cooke, D.W., 15:2921
Klarer, P.R., Autonomous land navigation in a structured environment, 15:3138 (R;US)
Klatt, C., Construction of a new 4π parallel plate detector for the Crystal Ball, 15:3341 (RA;DE;In German)
Kleb, R., *See* Jorgensen, J.D., 15:3358
Klein, A., *See* Baur, G., 15:4077
Klein, G., *See* Orth, C.D., 15:4475
Klein, W.H., Specifying monthly mean surface temperatures in Canada and Alaska from the 500 mb height field, 15:3398 (J;US)
Kleinman, L., Vertical distribution of pollutants in the presence of convective storms, 15:3406 (R;US)
Kleinman, M., *See* Colome, S.D., 15:3447
Klem, J.F., *See* Lott, J.A., 15:3004
Klemm, R.B., *See* Yetter, R.A., 15:3087
Klems, J., *See* Papamichael, K., 15:2335
Klems, J.H., Short-time-scale measurements of fenestration thermal performance under realistic springtime conditions, 15:2343 (BA;US)
Klepper, L.Ya., Mathematical model for evaluation of delayed injuries of rectum in radiotherapy, 15:3738 (RA;SU;In Russian)
Klimas, P.C., Aerodynamic performance of the Sandia National Laboratories 34-meter-diameter vertical axis wind turbine test bed, 15:2407 (BA;US)
See Rajagopalan, R.G., 15:2391
Klinzing, G., *See* Morsi, B.I., 15:2015
Kloop, R.W., *See* Giovanola, J.H., 15:2806
Klopcic, J.T., Modeling casualties in nuclear warfare. Final report, 15:3385 (R;US)
Klump, H.H., The thermodynamic basis of the genetic code, 15:3731 (RA;DE)
Knab, L.I., *See* Clifton, J.R., 15:2219

Knapp, D.A., *See* Brown, C.M., 15:3925
Knapp, E.A., *See* Alde, D., 15:3969
Knapp, J.A., In-situ ion beam measurements of deuterium loading in thin foil electrochemical cells, 15:2853 (R;US)
See Pope, L.E., 15:2862
Knauer, J.P., *See* Marshall, F.J., 15:4484
Knauss, K.G., *See* Bourcier, W.L., 15:2240
See Worlery, T.J., 15:2238
Kneedler, E.M., *See* Williams, G.P., 15:3283
Kneis, H., *See* Brueckner, W., 15:3955
Kneissl, U., *See* Weber, T., 15:4113
Knoefel, M.J., Licesing of mining and milling facilities of uranium and/or thorium ores, 15:2248 (R;BR;In Portuguese)
Knoepfle, K.T., *See* Khan, S., 15:4072, 15:4075, 15:4076, 15:4089, 15:4135
See Weber, T., 15:4113
Knop, G., *See* Arnold, F., 15:3350
Knowlton, T.M., *See* Sishtla, C., 15:2048
Knox, C.A., Design and operation of gamma scan and fission gas sampling systems for characterization of irradiated commercial nuclear fuel, 15:2440 (R;US)
Knudson, R., *See* Sciacca, F., 15:2543
Knysh, V.I., *See* Goldobenko, G.V., 15:3666
Kobayashi, Hisao, Neutron radiography and its image resolutions, 15:2250 (RA;JP;In Japanese)
See Tomura, Kenji, 15:4486
Kobayashi, Jun-ichi, *See* Ouchi, Hiroshi, 15:2826
Kobayashi, T., *See* Giovanola, J.H., 15:2806
Kober, G., *See* Korsch, W., 15:3322
See Reich, H., 15:3290
Koch, D., *See* Combs, J., 15:3580
Koch, G., *See* Breitbach, G., 15:4105
Koch, K., Modulation mixing in a multimode dye laser, 15:3153 (R;US)
Koehnlein, W., *See* Zell, I., 15:3734
Koenig, J.Q., *See* Frank, R., 15:3787
Koessler, V., *See* Duerr, W., 15:3263
Koffend, J.B., *See* Bott, J.F., 15:3146
Kogan, Ya.I., On the interactions of charged particles with cosmic string, 15:3987 (R;XA)
Kogut, J.B., What is the order of the transition from hadronic matter to the quark-gluon plasma?, 15:4006 (J;NL)
See Sinclair, D.K., 15:4005
Kohfeldt, E., *See* Hagen, U., 15:3706
Kohl, J.L., Coronagraph observations and analyses of the ultraviolet solar corona. Semiannual status report, 1 April 1987-31 March 1989, 15:3868 (R;US)
Kohler, H.S., Boltzmann-Uehling-Uhlenbeck and relaxation time methods: A comparison, 15:4171 (J;US)
Kolke, J., The dose, temperature, and projectile-mass dependence for irradiation-induced amorphization of CuTi, 15:2873 (J;US)
The projectile mass dependence of the amorphization process and the critical temperature in the ion irradiated CuTi, 15:2858 (BA;US)
Koistinen, R., Combustion of fixed-bed in grate firing, 15:3115 (R;FI;In Finnish)
Koivula, K., *See* Tapola, M., 15:2683
Kojima, Hiroaki, *See* Okumura, Yoshikazu, 15:4426
Kolb, G., *See* Menicucci, D., 15:2322
Koleda, A.A., *See* Berezhnov, I.P., 15:3637
Komar, C.A., Proceedings of the natural gas R&D contractors review meeting, 15:2142 (R;US)
Kominsky, J., Evaluation of airborne-asbestos concentrations before and during an O and M (operations and maintenance) activity: A case study, 15:3451 (R;US)
Kominsky, J.R., Asbestos-fiber reentrainment during vacuuming and wet cleaning of carpet at a captive research site, 15:3437 (R;US)
Statistical evaluation of airborne asbestos measured before, during, and after abatement, 15:3438 (R;US)
See Powers, T.J., 15:3256
Kondo, Katsumi, In situ measurement of neutral beam components using the Doppler-shifted H_α emissions in Heliotron E, 15:4345 (R;JP)
Kondo, T., Free radical generation by ultrasound in aqueous solutions of DNA constituents, 15:3718 (RA;DE)
Kondoh, Mitsunori, *See* Tachikawa, Katsuhiro, 15:4424
Kondratiev, R., *See* Khan, S., 15:4089
Kong, M.K., *See* Pitts, J.H., 15:3172
Konishi, Takao., *See* Hiraoka, Toru, 15:2462
Konradi, A., *See* Shea, M.A., 15:3851
Koopman, R.P., *See* Holve, D.J., 15:3469
Koori, N., Scatterings and reactions by means of polarized neutron beam, 15:4080 (RA;JP;In Japanese)
Koori, Norihiko, Polarized proton scattering on lithium isotopes at 14 MeV, 15:4427 (R;JP)
Kopietz, J., Hydrogeological, geohydraulic and geothermal studies in projected final storage sites for radioactive waste. Pt. 3. Geothermal studies. Final Report, 15:2200 (R;DE;In German)
Koponen, H. and others, Operation of Finnish nuclear power plants. Quarterly report, 2. quarter 1988, 15:2451 (R;FI)
Operation of Finnish nuclear power plants. Quarterly report, 3. quarter 1988, 15:2452 (R;FI)
Kornberg, H.A., *See* Mickelson, M.L., 15:3504
Kornilios, N., *See* McHargue, C.J., 15:2936
Korsch, W., Filter target experiment (FILTEX), 15:3322 (RA;DE;In German)
See Becker, K., 15:4097
Korsgaard, V., *See* Bolet, B., 15:2674
Korten, W., Investigation of many-phonon excitations in ^{232}Th, 15:4114 (RA;DE;In German)
See Gerl, J., 15:4115
See Klatt, C., 15:3341
Korytova, L.I., Use of subtotal body irradiation as the first stage of systemic antitumoral therapy of patients with generalized lymphogranulomatosis, 15:3645 (RA;SU;In Russian)
Kosenko, I.A., Injuries of healthy tissues in nontraditional regimen of dose fractionating in patients with cervix uteri carcinoma, 15:3662 (RA;SU;In Russian)
Kosevich, A.M., *See* Granada, J.C., 15:4216
Kosevich, Yu.A., *See* Granada, J.C., 15:4216
Kostelich, E.J., *See* Lathrop, D.P., 15:4298
Kostromina, K.N., *See* Pavlov, A.S., 15:3670
Kosusko, M., Destruction of volatile organic compounds using catalytic oxidation. Report for April 1987-December 1988, 15:3439 (R;US)
Kovalev, A.I., Peculiarities of surgical treatment of patients with radiation injuries, 15:3661 (RA;SU;In Russian)
Kover, A., *See* DuBois, R.D., 15:3921
Kovrov, V.P., Irreversibility and self-organization in spin glasses. 1. Origin of irreversibility in spin glasses, 15:4213 (R;XA)
Irreversibility and self-organization in spin glasses. 2. Irreversibility and the problem of configuration averaging, 15:4214 (R;XA)
Kowari, K., *See* Kimura, M., 15:3908
Koziar, G., Multizone completion opportunities in the Appalachian basin: Final report, 15:2138 (R;US)
Kozlowski, T., *See* Oothoudt, M.A., 15:3297
Kraemer, D., *See* Duerr, W., 15:3263
Krahl-Urban, B., [Discussions of global environmental problems]: Foreign trip report, October 14, 1989–October 21, 1989, 15:3426 (R;US)
Krakowski, R.A., Fusion burn dynamics in dense Z-pinches (DZP), 15:4342 (R;US)
Krall, A.H., Viscosity of a phase-separating critical mixture, 15:3210 (J;US)
Kram, T., National report for the Netherlands. The IEA energy technology systems analysis project (ETSAP)/Annex 3, 15:3470 (B;NL)
Kramp, J., Investigation of monoenergetic pair conversion, 15:3344 (RA;DE;In German)
Krankowsky, D., The neutral gas-mass-spectrometer onboard the GIOTTO-probe to Comet Halley, 15:3821 (RA;DE;In German)
Krantz, R.J., Bias and oxide thickness dependence of trapped-charge buildup in MOS (metal oxide semiconductors) devices. Technical report, 15:3222 (R;US)
High-energy-neutron irradiation effects in GaAs modulation-doped field effect transistors (MODFETs): Threshold voltage. Technical report, 15:3360 (R;US)
Kratenok, V.E., Possibilities of creation of information data bank in roentgenoradiology, 15:3627 (RA;SU;In Russian)
Krause, D., *See* Hesse, A., 15:2800

Krause, F., *See* Goldman, C.A., 15:2624
Krause, M.O., *See* Jimenez-Mier, J., 15:3923
Krause, P., *See* Baumann, W., 15:3293, 15:3294, 15:3345, 15:3889, 15:3890
Krauss, A., *See* Kaufherr, N., 15:2818
Krebs, H.J., *See* Fast, R.W., 15:3333
Kreider, J.F., *See* Johnson, B.K., 15:2334
Krein, G., *See* Henley, E.M., 15:4019
Kremens, R.L., *See* Marshall, F.J., 15:4484
Kremer, K., *See* Habs, D., 15:3270
Krenk, S., *See* Jeppesen, B., 15:3137
Krieger, A., *See* Arnold, F., 15:3350
Krikorian, O.H., Modeling of heat capacities of metals, 15:2867 (J;NL)
Kring, C.T., Results of the Manipulator Test Test Stand study: Comparison of manipulators and evaluation of equipment items, 15:2170 (R;US)
Krisch, A.D., First test of the Siberian snake magnet arrangement to overcome depolarizing resonances in a circular accelerator, 15:3281 (J;US)
Krishna, C.M., *See* Kondo, T., 15:3718
Krishnan, R.P., [US Agency for International Development–Government of India collaborative coal projects]: Foreign trip report, October 21, 1989–November 2, 1989, 15:2429 (R;US)
See Bradshaw, W.M., 15:2075
Krishnaswamy, P., *See* Cassady, M., 15:2150
Kristal, R., *See* Rosocha, L.A., 15:4453
Kristensen, J.W., *See* Jensen, S.A., 15:2385
Kroeger, P.G., *See* Van Tuyle, G.J., 15:2546
Kroehl, H.W., *See* Ahn, B., 15:3882
Krol, A., *See* Woronick, S.C., 15:3018
Kroll, N., *See* Blankenbecler, R., 15:4016
Kronenberg, A.K., Anisotropic yielding of rocks at high temperatures and pressures: Technical progress report No. 1, April 15, 1987–April 14, 1988, 15:2358 (R;US)
Kronfeld, A.S., Status of glueball mass calculations in lattice gauge theory, 15:3986 (R;US)
Kruechten, B. v., Developments at the Q3D spectrograph, 15:3338 (RA;DE;In German)
See Gyufko, R., 15:4090, 15:4092, 15:4093
Krueger, F.R., *See* Kissel, J., 15:3348, 15:3349
Kruglova, E.N., *See* Demidchik, E.N., 15:3641
Krumpelt, M., An assessment and comparison of fuel cells for transportation applications, 15:2794 (R;US)
See Minkov, V., 15:2758
See Redey, L., 15:2575
Krupke, W.F., *See* Payne, S.A., 15:3178
Krusche, G., Analysis, development and investigations into phase behaviour of surfactant systems for de-oiling high-salinitiy reservoirs with reference to the Bockstedt field of Wintershall AG. Final report, 15:2110 (R;DE;In German)
Krutilina, N.I., Modification of radiotherapy of patients with 1A-3A stage lymphogranulomatosis, 15:3646 (RA;SU;In Russian)
Kubiak, G.D., *See* Hamza, A.V., 15:3003
Kuehl, T., *See* Baumann, W., 15:3294
Kuehn, W., *See* Breitbach, G., 15:4105
See Hennrich, H.J., 15:4095
Kueny, C., *See* Crawford, J.D., 15:4310
Kuhl, D.E., New techniques for positron emission tomography in the study of human neurological disorders: Progress report, June 15, 1987–November 15, 1989, 15:3616 (R;US)
Kuhn, R., *See* Chen, Z.Y., 15:3097
Kuik, G.A.M. van, Actuator disc edge singularity. The key to a revised actuator disc concept and momentum theory, 15:2367 (RA;DK)
Kuja, A., *See* Jacobson, J., 15:3404
Kulaga, J.E., *See* DeLuca, W.H., 15:2582
Kulak, R.F., Critical time step estimation for three-dimensional explicit impact analysis, 15:2508 (R;US)
Kulcinski, G.L., *See* ElGuebaly, L.A., 15:4467
Kulessa, R., *See* Lubkiewicz, E., 15:4103
Kullk, A.V., *See* Alde, D., 15:3969
Kumabe, Isao, *See* Koori, Norihiko, 15:4427
Kumar, A., Optimizing voting-type algorithms for replicated data, 15:4541 (R;US)
See Ganapathi, L., 15:2949
Kun, E., *See* Sastry, S.S., 15:3597
Kunerth, D.C., *See* Telschow, K.L., 15:2915
Kunszt, Z., *See* Ellis, S.D., 15:4011
Kuo, T.T.S., *See* Jiang, M.F., 15:4174
Kupperman, D.S., Application of neutron diffraction NDE to high-temperature superconducting composites, 15:3213 (R;US)
Kurbatov, A.M., *See* Kovrov, V.P., 15:4213, 15:4214
Kurihara, Y., Multiplicity distribution of particles from string fragmentation calculated in a statistical model, 15:3994 (RA;DE)
See Aichelin, J., 15:3993
Kuriyama, Masaaki, *See* Matsuoka, Mamoru, 15:4422
Kustom, R., Microwave cavity studies for thermal testing of ceramic breeder materials, 15:2944 (BA;US)
Kuthi, A., Observation of a stable high-beta axisymmetric plasma equilibrium, 15:4382 (J;US)
Kuwabara, Mikinori, Spin trapping of sugar radicals in solid and aqueous phases, 15:3726 (RA;DE)
Kwan, J.W., Operation of a DC large aperture volume-production H^- source, 15:3305 (R;US)
See Inoue, T., 15:4439
Kwei, G.H., *See* Shen, Z., 15:2960
Kwok, M.A., *See* Bott, J.F., 15:3146
Kwok, R.S., *See* Cooke, D.W., 15:4256
Kwong, Man Kam, A comparison result and elliptic equations involving subcritical exponents, 15:4510 (R;US)

L

Labadier, J.W., *See* Chou, F.N.F., 15:2724
Labiak, W.G., *See* Christie, D.J., 15:4442
Labiosa, J., *See* April, R., 15:2768
Labiosa, J.E., Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)
Lackney, J., Three-dimensional inelastic analysis methods for hot section components, 15:3242 (RA;US)
Laemmerzahl, P., *See* Krankowsky, D., 15:3821
Laennergren, C., Effects on zooplankton when passing through an open lake water heat pump, 15:3800 (R;SE;In Swedish)
Laflen, J.H., *See* Kim, K.S., 15:3246
Lai, D.Y., *See* Krikorian, O.H., 15:2867
Laky, C., *See* Aunzo, Z., 15:2355, 15:2356
Lamade, G., *See* Breskin, A., 15:3346
Lamarche, F., *See* Bertrand, C., 15:3331
Lambert, J.D.B., *See* Bottcher, J.H., 15:2463
Lambertson, G.R., *See* Goldberg, D.A., 15:3307
Lamson, K.C., *See* Shinn, J.H., 15:3468
Lance, C.A., *See* Eather, R.H., 15:3884
Landen, O.L., *See* Szoke, A., 15:3916
Landis, G.A., Lunar production of solar cells, 15:2295 (R;US)
Landon, J.L., *See* McElroy, D.L., 15:2186
Lane, B., *See* Luckhardt, S.C., 15:4323
Lane, N.F., *See* Johnson, L.K., 15:3918
See Zygelman, B., 15:3913
Lane, P.A., *See* O'Rourke, T.D., 15:3254
Laney, P.T., *See* McElroy, D.L., 15:2186
Langdon, A.B., Relativistic extension of the electromagnetic direct implicit PIC algorithm, 15:4357 (R;US)
See Hewett, D.W., 15:4356
Lange, W., Methanol fuel M 100. Study into boundary conditions and optimisation of constituents, 15:2785 (R;DE;In German)
Langer, S., Just how much water is required to cool a molten core?, 15:2519 (R;US)
Langer, W.D., Silicon chemistry in interstellar clouds, 15:3866 (R;US)
Langley, R.A., Graphite as a plasma-facing material in fusion experiments, 15:4389 (R;US)
See Caughman, J.B.O. II, 15:4392
Langner, D.G., *See* Hsue, S.-T., 15:2246
Lankford, J., *See* Beaty, K., 15:2783
Lanza, E.G., *See* Harney, H.L., 15:4147

Lapointe, M.R., Antiproton powered propulsion with magnetically confined plasma engines, 15:2780 (R;US)
Lari, R.J., *See* Thompson, K.M., 15:3317
Lariucci, C., Characterization of the emerald of Santa Terezinha de Goias by spectroscopy, fluorescence and X-ray difraction, 15:4226 (R;BR;In Portuguese)
Larkins, P.M., Standard Review Plan for a petition for rulemaking on radioactive waste streams below regulatory concern: Expedited review in accordance with Appendix B to 10 CFR, Part 2: Data report for comment, 15:2213 (R;US)
Larsen, E.W., *See* Lorence, L.J. Jr., 15:2474
Larsen, I.L., *See* Todd, J.F., 15:3490
Larsen, J.W., *See* Yamada, O., 15:2019, 15:2020
Larsen, S.E., *See* Berkowicz, R., 15:3420
Larson, B.C., Interface temperatures and temperature gradients in silicon during pulsed laser irradiation, 15:2999 (BA;US)
Larson, D.W., *See* Christie, D.J., 15:4442
Larson, H.A., Faster-than-real-time simulation for plant control, 15:2478 (R;US)
Larson, S.M., Antigen-specific composition and in-vivo methods for detecting and localizing an antigenic site and for radiotherapy, 15:3682 (P;US)
Larson, T.K., INEL [Idaho National Engineering Laboratory] support to modernization efforts at the Aberdeen Proving Ground, 15:4515 (R;US)
Lashmore, D.S, *See* Bennett, L.H., 15:2812
Lassen, L., *See* Bellm, D., 15:4086
Lath, A., *See* Benvenuti, A., 15:3357
Latham, P.E., Linear analysis of a free-electron laser coupled to betatron oscillations, 15:3182 (J;US)
Lathrop, D.P., Characterization of an experimental strange attractor by periodic orbits, 15:4298 (J;US)
Lau, A.M.F., Measurement of transition moments between molecular excited electronic states using the Autler-Townes effect, 15:3175 (J;US)
The Autler-Townes effect in hydrogen at low pressure, 15:3902 (J;US)
Lau, Chun Wei, An engineering model for coal devolatilization: Quarterly report, March 15, 1989–June 15, 1989, 15:2098 (R;US)
Lau, K.H., *See* Hildenbrand, D.L., 15:3092
Lau, Y.Y., Classification of beam breakup instabilities in linear accelerators, 15:3282 (J;US)
Lauer, J.L., Continuous high-temperature lubrication of ceramics by carbon generated catalytically, 15:2900 (R;US)
Lauffer, J.P., *See* Carne, T.G., 15:2408
Laumann, C.W., *See* Smith, J.R., 15:4451
Lauth, W., *See* Achenbach, W., 15:4117
Lautridou, P., *See* Quebert, J., 15:4063
LaVilla, R.E., *See* Brown, C.M., 15:3925
Lavoie, R.G., *See* Lister, D.H., 15:2445
Lawkins, W.F., *See* Gillies, G.T., 15:3211
Lawrence, G.P., *See* Cooke, D.W., 15:3128
Lawrence, W.P., *See* Sheen, S.H., 15:3366
Laws, G.L., Air quality monitoring at toxic waste sites: A Hanford perspective, 15:3464 (R;US)
Lawson, J.K., *See* Christie, D.J., 15:4442
Lawson, M.A., *See* Gillies, G.T., 15:3211
Lawson, R.D., *See* Segel, R.E., 15:4081
Leach, J.M., *See* Sherman, D.H., 15:2827
Leach, M.J., *See* Patrinos, A.A.N., 15:3472
Leadon, S.A., Production of oxidative DNA damage during the metabolic activation of benzo[α]pyrene in human mammary epithelial cells correlates with cell killing, 15:3794 (J;US)
Leary, K.J., *See* Windingland, L.M., 15:2604
Leax, T.R., *See* Chung, H.M., 15:2825
LeBaron, B.A., *See* Michalsky, J.J., 15:2699
Lebed, A.G., Theory of unusual anisotropy of magnetoresistance in organic superconductors, 15:3011 (J;US)
LeBlanc, G., Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1986. Report for 1 January-31 March 1986, 15:2031 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1986. Report for 1 April-30 June 1986, 15:2032 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1986. Report for 1 July-30 September 1986, 15:2033 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1986. Report for 1 October-31 December 1986, 15:2034 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1987. Report for 1 January-31 March 1987, 15:2035 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1987. Report for 1 April-30 June 1987, 15:2036 (R;US)
Environmental Monitoring plan for the Dow Syngas Project. Quarterly report: Third quarter, 1987. Report for 1 July-30 September 1987, 15:2037 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1987. Report for 1 October-31 December 1987, 15:2038 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1987. Report for 1 January-31 December 1987, 15:2039 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1988. Report for 1 April-30 June 1988, 15:2040 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1988. Report for 1 July-30 September 1988, 15:2041 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2042 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual report. Report for 1 April 1988-31 March 1989, 15:2043 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1989. Report for 1 April-30 June 1989, 15:2044 (R;US)
Leboeuf, J-N., *See* Spong, D.A., 15:4304
Lebrun, C., *See* Quebert, J., 15:4063
Lechter, W., Process for single-crystal growth of high T(c) superconductors, 15:2965 (P;US)
Leckner, B., *See* Aamand, L.E., 15:2074, 15:3466
See Johnsson, F., 15:2101
See Lyngfelt, A., 15:3250
Ledbetter, D.H., *See* Caskey, C.T., 15:3603
Ledeboer, T., *See* Jackson, M., 15:3786
Lee T.S., *See* Kim, J.H., 15:2805
Lee, A.T., Broadband cryogenic preamplifiers incorporating GaAs MESFETs for use with low-temperature particle detectors, 15:3232 (J;US)
Lee, D.J., *See* Howard, C.G., 15:2175
Lee, D.W., Applied exposure modeling for residual radioactivity and release criteria, 15:3693 (R;US)
Lee, H.C., *See* Oldfield, E., 15:2957
Lee, H.W.H., Intra-stark relaxation of Nd^{3+} in silicate glass: Subpicosecond accumulated photon echo experiments, 15:4237 (R;US)
Lee, Hung Sui, *See* Hale, P.D., 15:3600
Lee, J., *See* Jacobson, J., 15:3404
Lee, L.L., *See* Cochran, H.D., 15:3073
See Wu, R., 15:3932
Lee, M.A., Particles accelerated by shocks in the heliosphere, 15:3859 (RA;US)
See Shea, M.A., 15:3851
Lee, R., *See* Hong, R., 15:4415
Lee, T.-S.H., Pion distribution in the nucleon, 15:3975 (R;US)
Lee, T.D., *See* Friedberg, R., 15:4259
Lee, T.S.H., *See* Nozawa, S., 15:3977
Lee, V.D., *See* Lousteau, D.C., 15:4387
Lee, W.W.-L., Release rates of soluble species at Yucca Mountain, 15:2210 (R;US)
See Hwang, Y., 15:2206, 15:2207
See Kim, C.-L., 15:2205
See Light, W.B., 15:2209
Lee, W.W.L., *See* Hwang, Y., 15:2212
See Zwahlen, E.D., 15:2211

Lee, Y.C., *See* Chen, H., 15:4296
Lee, Y.T., *See* Zhao, X., 15:3098
Leeper, R.J., *See* Ruiz, C.L., 15:3311
Leeper, S.A., Membrane applications in the food industry: Survey and barriers, 15:2728 (R;US)
LeGallo, Y., *See* Arastoopour, H., 15:2137
Leggett, R.W., The behavior and chemical toxicity of U in the kidney: A reassessment, 15:3753 (J;US)
Lehto, W.K., Expert system applications in support of system diagnostics and prognostics at EBR-II, 15:2505 (R;US)
See Larson, H.A., 15:2478
Lehwald, S., *See* Voigtlander, B., 15:2895
Lei, J.F., Elevated temperature strain gages, 15:3368 (RA;US)
Leibovitch, C., Effect of electron prebunching on the radiation growth rate in a collective (Raman) free electron laser amplifier, 15:4366 (BA;US)
Leifeste, G.T., RADLAC-II propagation experiments, 15:3895 (R;US)
See Haworth, M.D., 15:3275
Leino, O., Design instructions for ventilation of day-care centres, 15:2684 (R;FI;In Finnish)
Leinonen, A., *See* Aho, V.J., 15:2087
Leinwand, S., *See* Goguen, J.A., 15:4500
Leivo, M., Frost resistance of concrete in artic offshore structures, 15:2755 (R;FI;In Finnish)
Lele, S. K., *See* Ho, C. M., 15:3204
Lemieux, P.M., *See* Watts, R.R., 15:3440
Lemmel, H.D., Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988, 15:4134 (R;XA)
Lemsky, J.A., *See* Sherman, D.H., 15:2827
Lennox, A.J., Proton linac for hospital-based fast neutron therapy and radioisotope production, 15:3619 (R;US)
Lenschow, D.H., Global tropospheric chemistry: Chemical fluxes in the global atmosphere, 15:3393 (R;US)
Lenzing, A., *See* Burkert, E., 15:3347
Leon, M., Interpretation of recent LAMPF results on D T MU formation, 15:4073 (R;US)
Leonhardt, W., *See* Carroll, A., 15:3269
Leppaelahti, J., Electricity production at fuel cell power plants, 15:3252 (R;FI;In Finnish)
Lerch, B. A., *See* Ghosn, L. J., 15:2975
Leroy, C., *See* Bertrand, C., 15:3331
Leslie, N.P., Conventional research house: Cooling characterization test results. Topical report, June-September 1987, 15:2697 (R;US)
Lesser, V., Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
Lessner, E., *See* Krusche, G., 15:2110
Lessner, E.S., Weighted fit of parametric functions to distributions: The new interface of HOBOOK with MINUIT, 15:4516 (R;US)
Lester, C.S., *See* Tallman, C.R., 15:3170
Lester, D.T., Geographic variation in red alder. Forest Service research paper, 15:2299 (R;US)
Letts, S.A., *See* Hair, L.M., 15:2986
Letzring, S., *See* Kessler, T.J., 15:4370
See Skupsky, S., 15:3184
Letzring, S.A., *See* Marshall, F.J., 15:4484
Leucker, H., *See* Becker, K., 15:4097
See Reich, H., 15:3290
Leung, K.N., A high charge state multicusp ion source, 15:3304 (R;US)
See Kwan, J.W., 15:3305
Leung, T.C., *See* Zhao, G., 15:2892
Leuterer, F., *See* Yoshioka, K., 15:4326
Levin, S.M., *See* Gavin, L.M., 15:3131
Levine, M., *See* Goldman, C.A., 15:2624
Levine, R.D., *See* River, N., 15:4261
Levine, Z.H., An energy-minimizing mesh for the Schroedinger equation, 15:4289 (J;US)
Levush, B., Effect of mode competition on the efficiency of FEL oscillators in the low gain regime, 15:3169 (BA;US)
Levy, R.P., *See* Frankel, K.A., 15:3677
See Rosander, K., 15:3745
Lewandowski, A., *See* O'Gallagher, J., 15:2348
Lewi, J., *See* Van Kote, F., 15:2197
Lewin, K.F., *See* Lipfert, F.W., 15:3405
Lewis, B.M., *See* O'Hare, P.A.G., 15:2968
Lewis, M.B., *See* Caughman, J.B.O. II, 15:4392
Lewtas, J., Complex mixtures of urban air pollutants: Identification and comparative assessment of mutagenic and tumorigenic chemicals and emission sources, 15:3784 (R;US)
See DeMarini, D.M., 15:3612
Lhallabi, T., *See* Kachkachi, M., 15:4276
Li, G., Comment on "Self-similarity of diffusion-limited aggregates and electrodeposition clusters", 15:2880 (J;US)
Li, J., Thermally and ion-induced phase formation in a Pd/Ge bilayer, 15:2882 (J;US)
Li, M.F., *See* Shan, W., 15:3033
Li, Shu-mei W., *See* Cataldo, D.A., 15:3463
Li, X., *See* Coutts, T.J., 15:2317
See Ma, Y., 15:2894
Liburdy, R.P., The influence of oscillating electromagnetic fields on membrane structure and function: Synthetic liposome and natural membrane bilayer systems with direct application to the controlled delivery of chemical agents, 15:3802 (R;US)
Lichard, P., *See* Kapusta, J., 15:4008
Lichtenwalner, D.J., Plasma-activated ion-beam reactive sputtering of NbN thin films, 15:2898 (R;US)
Lichti, R.L., *See* Cooke, D.W., 15:4256
Lienau, P.J., *See* Lunis, B.C., 15:2357
Liesen, D., *See* Baumann, W., 15:2345
Lietzke, A.F., *See* Kwan, J.W., 15:3305
Liff, R., *See* Granholm, A., 15:2613
Light, W.B., Analytical models for C-14 transport in a partially saturated, fractured, porous media, 15:2209 (R;US)
See Kim, C.-L., 15:2205
Ligotke, M.W., *See* Cataldo, D.A., 15:3463
Lilja, R., Qualitative modeling and control of combustion, 15:3251 (R;FI;In Finnish)
Lima, J.E.P., Computer-aided event tree analysis by the impact vector method, 15:2475 (R;BR;In Portuguese)
Lima, J.F. de., Thermoluminescent of induced calcite by gamma and ultraviolet radiation, 15:4225 (R;BR;In Portuguese)
Lima, M.I.C. de, Geology and Geochronology of Abuna-Ariquemes-RO, 15:3044 (R;BR;In Spanish)
Lin, C.L., *See* Qiu, S.L., 15:4253
Lin, H., Temperature fluctuations and transport in a tokamak edge plasma, 15:4379 (J;US)
Lin, H.Q., *See* Emery, V.J., 15:2904
Lin, K.C., Effect of media properties on side erase bands, 15:4521 (R;US)
Lin, Mow S., *See* Premuzic, E.T., 15:2107
Lin, S.H., *See* Fain, B., 15:3099
Linak, W.P., *See* Watts, R.R., 15:3440
Lind, T., Development of the method for measuring the thickness of a milled peat layer, 15:2090 (R;FI;In Finnish)
Lindau, I., *See* Dessau, D.S., 15:2956
See Shen, Z., 15:2960
Lindberg, P.A.P., *See* Dessau, D.S., 15:2956
See Shen, Z., 15:2960
Lindberg, S.E., [Deposition of atmospheric nitrogen species to forests in North America and Europe]: Foreign trip report, September 24–October 11, 1989, 15:3422 (R;US)
Lindh, T., Development of a mesuring method for the efficiency of milled peat production, 15:2089 (R;FI;In Finnish)
Lindholm, U.S., Constitutive modeling for isotropic materials, 15:3243 (RA;US)
Lindl, B., *See* Brucker, A., 15:4109
Lindquist, W.B., *See* Lousteau, D.C., 15:4387
Lindstroem, G., *See* Bertrand, C., 15:3331
Lineberry, M.J., *See* Forrester, R.J., 15:2502
Linetsky, V.Ya., *See* Fradkin, E.S., 15:4039
Linhares, C.A., SU(4) proprerties of the Dirac equation, 15:4032 (R;BR)
Link, H., Operational experience of the OC-OTEC experiments at NELH, 15:2331 (BA;US)

Linkous, C.A., Direct insertion of metal ions into tetrasulfonated phthalocyanine, 15:3071 (R;US)
Lipfert, F.W., FACE: A free-air facility for fumigation with gaseous air pollutants: Revision, 15:3405 (R;US)
Lipnick, R.L., *See* Bradbury, S.P., 15:3778
Lippmann, M.J., *See* Aunzo, Z., 15:2355, 15:2356
Lisin, V., *See* Khan, S., 15:4089
Lister, D.H., Deposition of cobalt on surface-treated stainless steel under PWR conditions, 15:2445 (R;US)
Little, R.C., *See* Forster, R.A., 15:3378
Littlejohn, D, *See* Chang, S.G., 15:2076
Litzke, J., *See* Huebel, K., 15:3567
Liu, A., *See* Strangman, T.E., 15:2925
Liu, A.S., *See* Birtcher, R.C., 15:2864
Liu, C., Surface magneto-optical studies of ultrathin ferromagnetic films, 15:2822 (R;US)
Liu, C.T, *See* Cathcart, J.V., 15:2896
Liu, C.T., *See* McKamey, C.G., 15:2874
Liu, D.K., *See* Chang, S.G., 15:2076
Liu, J.-Z., *See* Rothman, S.J., 15:2914
Liu, M.K., *See* Morris, R.E., 15:3453
Liu, W., *See* Gottlieb, S., 15:4060
Livbjerg, H., *See* Dam-Johansen, K., 15:3419
Livengood, C.D., Fluid/particle separation and coal cleaning: Progress, potential advances, and their effects on FGD [flue-gas desulfurization], 15:2420 (R;US)
See Harkness, J.B.L., 15:2421
Lloyd, V.D., Radiological surveys of Naval facilities on Puget Sound. Final report, 15:3571 (R;US)
Lloyd, W.R., *See* Graham, S.M., 15:2833
Lo, E.H., *See* Rosander, K., 15:3745
Lo, I.Y., In situ XRF and gamma ray spectrometer for Mars sample return mission, 15:3355 (RA;US)
Lobao, N., Simultaneous determination of Rn-220 and Rn-222 concentrations in atmospheres by cellulose nitrate ionographic detectors, 15:3056 (R;BR;In Portuguese)
Lockner, T.R., *See* Ruiz, C.L., 15:3311
Loevblad, G., *See* Westling, O., 15:3478
Logan, B.G., *See* Campbell, R.B., 15:4464
See Hoffman, M.A., 15:4444
Loh, E.Y. Jr., *See* Campbell, D.K., 15:4231
Loken, S.C., *See* Oothoudt, M.A., 15:3297
London, R.A., Radiation damage and its influence on source requirements for high resolution x-ray holography, 15:3680 (R;US)
Long, J.C.S., *See* Majer, E.L., 15:3812
Long, L.T., *See* White, R.M., 15:3813
Long, W.H., *See* Tallman, C.R., 15:3170
Longhurst, G.R., Atmospheric detritiation system performance, 15:4406 (R;US)
Longmire, V.L., *See* Hsue, S.-T., 15:2246
Lonneman, W.A., Comparison of 0600-0900 AM hydrocarbon compositions obtained from 29 cities, 15:3431 (R;US)
Loo, J.A., *See* Smith, R.D., 15:3371
Lopes, R.T., Computerized tomographic in non-destructive testing, 15:3334 (R;BR;In Portuguese)
Loree, T.R., Liquid excimers: lasing Xe_2 and Kr_2 in liquid argon, 15:3179 (J;US)
Lorence, L.J. Jr., An S_2 synthetic acceleration scheme for the one-dimensional S_{eta} equations with linear discontinuous spatial differencing, 15:2474 (J;US)
Physics guide to CEPXS: A multigroup coupled electron-photon cross-section generating code: Version 1.0, 15:3894 (R;US)
Lorenz, I., Thermoluminescence dating of archaeometallurgical slags and ceramics, 15:3059 (RA;DE;In German)
Loreti, M., *See* Benvenuti, A., 15:3357
Lott, J.A., Anisotropic thermionic emission of electrons contained in GaAs/AlAs floating gate device structures, 15:3004 (J;US)
Lotze, K.H., Simultaneous creation of electron-positron pairs and photons in Robertson-Walker universes with statically bounded expansion, 15:4035 (R;XA)
Louge, M.Y., Development and utilization of new diagnostics for dense-phase pneumatic transport: Quarterly technical progress report, July 1, 1989–September 30, 1989, 15:2084 (R;US)
Loule, S.G., Variational quantum Monte Carlo calculation of electronic and structural properties of crystals, 15:4235 (R;US)
Louis, W.C., *See* Oothoudt, M.A., 15:3297
Louis-Jacquet, M., Soft X-Ray amplification in laser plasmas, 15:4300 (R;FR)
See Naccach, D., 15:4369
Lousteau, D.C., The International Thermonuclear Experimental Reactor configuration evolution, 15:4387 (R;US)
Lovell, E.G., *See* Moses, G.A., 15:4461
See Olson, R.E., 15:4477
Lowden, P., *See* Swaminathan, V.P., 15:2414
Lowe, J., *See* Whitehouse, D.A., 15:3971
Lowndes, D.H., *See* Godbole, M.J., 15:2878
Lu, Fu-Hsing, *See* Boeer, K.W., 15:2301
Lu, G.Q., Time-resolved reflectivity measurement of the pressure-enhanced crystallization rate of amorphous Si in a diamond anvil cell, 15:2995 (BA;US)
Lubell, M.S., *See* Shen, S.S., 15:4478
Lubkiewicz, E., Measurement of g-factors in Yb isotopes, 15:4103 (RA;DE)
Lucchitta, B.K., Valles Marineris, Mars: an optimum science-sample site, 15:3834 (RA;US)
Lucero, R.F., Use of foaming mud cement to terminate underground coal fires and to control subsidence of burn cavities. Final report, 15:2091 (R;US)
Lucero, S.J., *See* Haworth, M.D., 15:3275
Lucht, R.P., *See* Rakestraw, D.J., 15:3377
Luck, W., *See* Becker, K., 15:4097
See Korsch, W., 15:3322
Luckhardt, S.C., Effect of finite fast electron confinement on ECRH and LH current drive and heating, 15:4324 (RA;JP)
Production of high poloidal tokamak equilibria in Versator II by means of RF current drive, 15:4323 (RA;JP)
Ludlam, T.W., High energy heavy ion collisions and the RHIC [Relativistic Heavy Ion Collider] project at Brookhaven, 15:3261 (R;US)
Ludwig, W., *See* Ender, C., 15:3343
Lue, J.W., *See* Shen, S.S., 15:4478
Luecking, W., *See* Bellm, D., 15:4086
Luft, W., Characteristics of hydrogenated amorphous silicon-germanium alloys, 15:2863 (BA;US)
Lui, A.T.Y., Extension of lower hybrid drift instability into the neutral sheet of the earth's magnetotail, 15:4367 (BA;US)
Lundberg, L.B., High-temperature interdiffusion and phase equilibria in U-Mo, 15:2868 (J;NL)
Lunis, B.C., Geothermal direct use projects in the United States: Status and trends, 15:2357 (R;US)
Luo, Y.L., *See* Kawai, M., 15:4165
Lusnikov, A., *See* Ohana, I., 15:2937
See Withrow, S.P., 15:2994
Lustiger, A., *See* Cassady, M., 15:2150
Luton, J.N., *See* Shen, S.S., 15:4478
Lutsko, J.F., *See* Phillpot, S.R., 15:2821
Lutz, I., *See* Stover, R., 15:3280
Lutz, J.L., *See* Suits, B.H., 15:4201
Lykke, K.R., *See* Kay, B.D., 15:3094
Lykken, J., *See* Dixon, L.J., 15:4025
Lyman, J.L., *See* Finch, F.T., 15:2271
Lyman, J.T., *See* Frankel, K.A., 15:3677
Lynels, C.M., ECR sources for the production of highly charged ions, 15:3306 (R;US)
Lyngfelt, A., Effect of reductive decomposition of $CaSO_4$ on sulphur capture in fluidised bed boilers, 15:3250 (R;SE)
Lyo, S.K., Magnetoquantum oscillations of the phonon-drag thermoelectric power in heterojunctions, 15:4245 (J;US)

M

Ma Zhongqi., Quantum sl(2) enveloping algebra and representations of braid group, 15:4271 (R;XA)
Ma, E., Heavy-Majorana-neutrino production, 15:4010 (J;US)
Ma, Y., Patterson analysis of aperiodic crystals, 15:2894 (J;US)
MacGill, R.A., Some novel design features of the LBL metal vapor vacuum arc ion sources, 15:3303 (R;US)

See Brown, I.G., 15:3301
See Galvin, J.E., 15:3302
MacGowan, B., *See* Naccach, D., 15:4369
Macha, J.M., An experimental investigation of wall-interference effects for parachutes in closed wind tunnels, 15:3139 (R;US)
Machado, L.M., *See* Armelin, M.J.A., 15:3048
Maciolek-Blake, N., Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2, 15:2130 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices, 15:2131 (R;US)
Mack, A.M., *See* Hintz, N.M., 15:4064
Mackowiac, D.P., *See* Reny, D.A., 15:2193
Madadakis, E., *See* Gyufko, R., 15:4090, 15:4092, 15:4093
Madix, R.J., *See* Stevens, P.A., 15:3090
Maeda, Atsushi and other, *See* Arai, Yasuo, 15:2461
Maeda, Hikosuke, *See* Kishimoto, Yasuaki, 15:4341
Maeda, K., *See* Suda, T., 15:4074
Maeda, Kazuhide, *See* Koori, Norihiko, 15:4427
Maeda, Kazuto, *See* Baba, Mamoru, 15:4119
Maekawa, Takashi, Lower hybrid current drive and suppression of MHD instabilities on WT-3, 15:4322 (RA;JP)
Maenchen, J., *See* Ruiz, C.L., 15:3311
Maenner, R., *See* Ender, C., 15:3343
Maez, M.A., *See* Cooke, D.W., 15:2921
Magdich, P., Removal of oil from oil-water mixtures using selective oil filtration. Masters thesis, 15:2132 (R;US)
Magnus, P.V., *See* Wang, T.F., 15:4082
Mahajan, B.M., Method for measuring the effectiveness of gaseous-contaminant removal filters, 15:3257 (R;US)
Maiers, D.T., *See* Pryfogle, P.A., 15:3546
Maihara, V.A., *See* Armelin, M.J.A., 15:3048
Mairle, G., *See* Khan, S., 15:4135
Majer, E.L., VSP [Vertical Seismic Profiling] and cross hole tomographic imaging for fracture characterization, 15:3812 (R;US)
See Green, M.A., 15:3299
Majid, C.A., Strain induced amorphization of aluminium by manganese implantation, 15:4215 (R;XA)
Studies of the effect of age on the structure of polycrystalline ReO_3, 15:2918 (R;XA)
Majumdar, S., *See* Kupperman, D.S., 15:3213
Makarova, G.V., *See* Klepper, L.Ya., 15:3738
Makedanz, A., Experience in the use of the UA-type teaching kit of sealed radioactive sources, 15:4199 (R;DD;In German)
See Glaeser, M., 15:4198
See Goergner, D., 15:4196
Maki, R.G., *See* Yetter, R.A., 15:3087
Makida, Y., *See* Shintomi, T., 15:3296
Makovich, L., *See* Hollander, S., 15:2418
Makri, N., A semiclassical tunneling model for use in classical trajectory simulations, 15:3086 (J;US)
Theoretical methods for the study of chemical dynamics, 15:3078 (R;US)
See Miller, W.H., 15:3079
Malave, M., *See* Jackson, M., 15:3786
Malik, R.P., *See* Kaul, R.K., 15:4036
Malik, S.N., *See* Kim, K.S., 15:3246
Malik, S.S., *See* Khosla, H.S., 15:4130
Mallavarpu, R., *See* Dionne, N., 15:4455
Mallen, A.N., *See* Van Tuyle, G.J., 15:2496
Mallett, R.L., *See* Haller, K., 15:3942
Malone, R.D., *See* Komar, C.A., 15:2142
Mamontov, A.S., *See* Kiseleva, E.S., 15:3644
Mamontov, V.V., Potentialities of Simulix-Simtomix complex use for preradiation preparation of patients with lung cancer, 15:3647 (RA;SU;In Russian)
See Dzhevechka, I.I., 15:3642
Mancinelli, R.L., *See* Stoker, C.R., 15:3842
Mandrekas, J., *See* Pautasso, G.R., 15:4483
Mane, S.R., *See* Krisch, A.D., 15:3281
Manglos, S.H, Neutron range spectrometer, 15:3359 (P;US)
Mankofsky, A., *See* Lui, A.T.Y., 15:4367
Mann, A., *See* Kerfoot, W.B., 15:3573
See Ketchum, B.H., 15:3574
Mann, M.E., *See* de Fontaine, D., 15:2948
Mannheim, P.D., *See* Haller, K., 15:3942
Manning, S.L., *See* Demasi, J.T., 15:2927
Mannsperger, H., *See* Behar, M., 15:4227
Manohar, A., *See* Jaffe, R.L., 15:4290
Mansfield, C.R., *See* Rosocha, L.A., 15:4453
Mansfield, D.K., *See* Park, H.K., 15:4350
Mansour, N., *See* Piepke, A., 15:4104
Manwell, J., *See* Stein, W., 15:2399
Manwell, J.F., A case study of a no storage wind/diesel system: Block Island, 15:2400 (BA;US)
Marathe, S.G., Fuel Chemistry Division annual progress report for 1986, 15:2163 (R;IN)
Marchand, A.P., High-energy-density solid and liquid hydrocarbon fuels. Final report, July 1987-December 1988, 15:2120 (R;US)
Marchaterre, J.F., *See* Pedersen, D.R., 15:2501
Marco, L.A.C. de, *See* Borghi, V.C., 15:3623
Marcotte, K., *See* Johnson, R., 15:2648
Marest, G., *See* McHargue, C.J., 15:2907, 15:2908, 15:2936
Maribo Pedersen, B., Joint action on aerodynamics of wind turbines. Supplement, 15:2379 (R;DK)
Marivoet, J., Performance assessment of geological isolation systems for radioactive waste. Disposal in clay formations, 15:2196 (R;FR)
Mark, F., *See* Sonntag, C. von, 15:3719
Markiewicz, W.J., *See* Drury, L.O'C., 15:3823
Markowitz, V.M., Abbreviated query interpretation in extended entity-relationship oriented databases, 15:4542 (R;US)
Maroni, V.A., *See* Melendres, C.A., 15:2946
Maronpot, R.R., *See* Peraino, C., 15:3599
Marotta, A.S., *See* Antal, J.J., 15:3212
Marquart, R., *See* Fleckenstein, T., 15:2028
Marques, N.M.G., *See* Lima, M.I.C. de, 15:3044
Marr, W.W., Analysis of life cycle costs for electric vans with advanced battery systems, 15:2583 (B;US)
Marrs, R.E., *See* Brown, C.M., 15:3925
Marsden, J.F., *See* Hayes, G.R., 15:2523
Marshall, F.J., Cryogenic-laser-fusion target implosion studies performed with the OMEGA uv-laser system, 15:4484 (J;US)
Marshall, J.W., *See* Joyce, J.P., 15:2650, 15:2651
Marshall, S.L., *See* Vandergrift, G.F., 15:3105
Martel, C.R., Properties of F-34 (JP-8) fuel for 1988. Summary report, January-December 1988, 15:2119 (R;US)
Martikainen, P, Sonic pyrometry in furnaces. Fundamentals, 15:3253 (R;FI;In Finnish)
Martin, R., *See* Sharafat, S., 15:4470
Martin, R.L., *See* Jenkins, M.G., 15:2913
Martin, R.S., *See* Williamson, A.D., 15:2696
Martoff, C.J., Muon capture at large y-energetic nucleon emission, 15:4083 (R;US)
The low energy frontier in high energy particle physics, 15:3332 (R;US)
See Auerbach, L.B., 15:3951
Martsynskij, Yu.S., *See* Sidorchenkov, V.O., 15:3653
Marumori, Toshio, *See* Sakata, Fumihiko, 15:4152
Marumori, Toshio., *See* Matsuo, Masayuki, 15:4155
Maruyama, T., Enhanced electron spin polarization in photoemission from thin GaAs, 15:3015 (J;US)
Marzo, M.A.S., *See* Menlove, H.O., 15:2168
Mascarenhas, Y.P., *See* Zukerman-Schpector, J., 15:4222
Mason, G.E., *See* Sierra Alcazar, H.B., 15:2579
Masoum, M.A.S., *See* Fuchs, E.F., 15:3225
Massalski, T.B., *See* Rizzo, H.F., 15:2860
Massey, B.M., *See* Faber, P.M., 15:3538
Massey, W., *See* Chocol, C., 15:4488
Massini, G., *See* Rossi, E., 15:2371
Massoth, F.E., Comprehensive characterization studies of sulfided molybdenum catalysts: Final progress report, 15:2828 (R;US)
Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 8, June 15, 1989–September 15, 1989, 15:2021 (R;US)
Masuzawa, Fumitake, Neutron radiography application to archaeological and ethnological objects, 15:3042 (RA;JP;In Japanese)
Mathews, M.A., *See* Hearst, J.R., 15:3390

Matl, K., *See* Arnold, W., 15:3321
Matos, J.E., *See* DiMeglio, A.F., 15:2488
See Mo, S.C., 15:2458
Matsuda, H.T., *See* Yamaura, M., 15:3052
Matsuda, Y., Effect of resonant-to-bulk electron momentum transfer on the efficiency of electron-cyclotron current-drive, 15:4327 (RA;JP)
Particle simulation of Alfven/ion-cyclotron instabilities in a neutral-beam current-driven plasma, 15:4320 (RA;JP)
Matsuda, Yasuhiro, *See* Okumura, Yoshikazu, 15:4426
Matsui, T., *See* Kataja, M., 15:4167
Matsumoto, S., Development of thermal-resistant catalysts, 15:2795 (R;JP)
Matsumura, N., *See* Hirano, T., 15:2695
Matsuo, Hideto, Stabilities of dimension and thermal-resistance of ASR-ORB carbon for thermal barrier materials of HTTR, 15:2491 (R;JP;In Japanese)
Matsuo, Masayuki, Dissipation mechanism of the large-amplitude collective motion. Dynamical evolution of a collective bundle of trajectories in the TDHF phase space for a simple soluble model, 15:4155 (R;JP)
Matsuoka, Mamoru, Estimation method of reionization loss in the drift ducts for JT-60 NBI, 15:4422 (R;JP;In Japanese)
Matsuoka, N., Measurement of (n,p) reactions using the spectrograph DUMAS and an apparatus for high resolution (n,p) experiments at intermediate energy, 15:3356 (RA;JP;In Japanese)
See Suda, T., 15:4074
Matsuyama, Toshiya, *See* Watanabe, Takao, 15:2656
Matsuzaki, Yoshimi, *See* Miura, Yukitoshi, 15:4420
Matthews, D., *See* Naccach, D., 15:4369
Matthews, S.M., Induction linear accelerators for commercial photon irradiation processing, 15:3267 (R;US)
Matthews, T.G., *See* Dudney, C.S., 15:2693
Mattor, N., Ion temperature gradient-driven turbulence in tokamaks with flat density profiles, 15:4376 (J;US)
Theory of weak ion temperature gradient-driven turbulence near the threshold of instability, 15:4375 (J;US)
Mattsson, J.E., Handling characteristics of wood fuels - angle of repose for different assortments, 15:2274 (R;SE;In Swedish)
Mauchien, P., *See* Berthoud, T., 15:3040
Maude, C.M., *See* Rodgers, B.R., 15:2409
Mauser, G., *See* Reiner, K., 15:4085
May, B., Quantification of Hungry Horse Reservoir water level needed to maintain or enhance reservoir fisheries: Methods and data summary, 1983–1987, 15:2278 (R;US)
Maya, L, Carbonaceous film coating, 15:3038 (P;US)
Mayer, J.W., *See* Li, J., 15:2882
Mayer, R., *See* Reich, H., 15:3290
Maynard, J.D., Acoustic studies of new materials: Quasi crystals, low-loss glasses, and high tc superconductors. Annual summary report, 1 October 1988-30 September 1989, 15:2901 (R;US)
Mayo, S.E., *See* Christie, D.J., 15:4442
Mazarakis, M.G., *See* Haworth, M.D., 15:3275
Mazdiyasni, K.S., High-temperature ceramic superconductors. Annual technical report, 24 May 1988-30 June 1989, 15:2899 (R;US)
Mazurek, A.P., *See* Osman, R., 15:3703
Mazurkevich, G.E., *See* Zhidkov, E.P., 15:4518
Mazzoni, S., *See* Bertrand, C., 15:3331
McAlice, A.J., *See* Poulsen, P., 15:3140
McAtee, J.L. III, *See* Nelson, D.C., 15:3482
McCallum, J.C., *See* McHargue, C.J., 15:2907, 15:2908
McCann, M.P., *See* Chen, C.H., 15:3174
McCann, M.W. Jr., Lower-bound magnitude for probabilistic seismic hazard assessment: Final report, 15:2526 (R;US)
McCardell, R.K., *See* Akers, D.W., 15:2486
McCarthy, D., *See* Nagle, D.P., 15:3596
McCarthy, J.D., Operational experience with Tevatron I antiproton source, 15:3268 (BA;US)
McCarthy, J.F., Biological (molecular and cellular) markers of toxicity: Semi-annual technical progress report (No. 2), April 1, 1989–September 30, 1989, 15:3765 (R;US)
Block-conjugate-gradient method, 15:4058 (J;US)
McCartney, M.L., *See* Benignus, V.A., 15:3755
McCarty, P.L., *See* Roberts, P.V., 15:3554
McClanahan, E.D., *See* Rizzo, H.F., 15:2860
McClelland, J.J., Superelastic scattering of spin-polarized electrons from sodium, 15:3909 (J;US)
McClelland, M.A., Time-dependent free convection in low Prandtl number fluids, 15:3207 (R;US)
McColl, N.P., *See* Mobbs, S.F., 15:2199
McCool, P.M., *See* Bytnerowicz, A., 15:3446
McCormick, R.D., *See* Golden, D.W., 15:2520
McDaniel, E.W., [Immobilization of technetium in blast furnace slag]: Foreign trip report, October 13, 1989–October 30, 1989, 15:2220 (R;US)
McDaniel, J.A., *See* Whitaker, R.B., 15:3380
Mcdonald, H., *See* Buggeln, R.C., 15:3200
McDonald, S.C., International aspects of restrictions of ozone-depleting substances, 15:3462 (R;US)
McEachern, R.L., Trajectory analysis of low-energy and hyperthermal ions scattered from Cu(110), 15:3887 (R;US)
McElroy, D.L., Site characterization program at the radioactive waste management complex of the Idaho National Engineering Laboratory: Annual progress report: FY-1988, 15:2186 (R;US)
McElroy, J.L., *See* Chapman, C.C., 15:2226
McEwen, L.H., Preliminary report, KW reactor incident, 15:2527 (R;US)
McFadden, K.M., *See* Cataldo, D.A., 15:3463
McFarlan, J.T., *See* Avens, L.R., 15:2203
McFarlane, K.W., *See* Auerbach, L.B., 15:3951
McFarlane, W.K., Status of BNL E791: Study of very rare K_L^0 decays, 15:3984 (R;US)
See Cooper, M.D., 15:3950
McFeeters, T.L., Hydrogen permeability coefficient determinations for used waste drum liners, 15:2985 (R;US)
McGill, J.A., *See* Cooke, D.W., 15:3128
McGowan, J., *See* Stein, W., 15:2399
McGowan, J.G., *See* Manwell, J.F., 15:2400
McGowin, C.R., 1988 interorganizational workshop on future utility SO_2 emissions, 15:2078 (R;US)
McGuire, J.H., *See* Wang, Y.D., 15:3920
McHarg, B.B. Jr., Data file management in the DIII-D data acquisition and analysis computer systems, 15:4412 (R;US)
McHargue, C.J., Structure of amorphous Al_2O_3 produced by ion implantation, 15:2908 (R;US)
The charge state of iron ions implanted into sapphire, 15:2936 (BA;US)
The effects of annealing on the structure and distribution of charge states of iron implanted into α-Al_2O_3 at 77 K, 15:2907 (R;US)
McHugh, G., *See* Jones, D.V.C., 15:2179
McInerney, J.G., *See* Park, J., 15:3180
McIntyre, E.K., *See* Whitehouse, D.A., 15:3971
McKamey, C.G., Effect of chromium on properties of Fe_3Al, 15:2874 (J;US)
Mckay, C.P., *See* Stoker, C.R., 15:3842
Mckibben, R.B., *See* Mewaldt, R.A., 15:3852
McKibben, R.B., Gradients of galactic cosmic rays and anomalous components, 15:3863 (RA;US)
Mcknight, R.L., Component specific modeling, 15:3241 (RA;US)
See Pilsner, B., 15:2926
McLaughlin, F.B., Influence of discharge and urbanization on the concentration, speciation, and bioavailability of trace metals in the Raritan River, New Jersey. Final report, 15:3551 (R;US)
McLaughlin, S.B. Jr., [Growth and physiology of red spruce in relationship to acidic deposition in the Great Smoky Mountains National Park, USA]: Foreign trip report, September 30, 1989–October 14, 1989, 15:3423 (R;US)
McLean, H.S., *See* Hartman, C.W., 15:4368
McLean, R.I., *See* Domotor, S.L., 15:2456
McLelland, G.R., *See* Boenig, H.J., 15:4434
McMackin, I., *See* Beck, M., 15:3183
McMahon, J.E., *See* Wood, D.J., 15:2685, 15:2686, 15:2687
McManamy, T.J., *See* Shen, S.S., 15:4478
McMillian, M., *See* Williams, M.C., 15:2080
McNamee, E., *See* Devgun, J.S., 15:2180
McNeil, R., *See* Chan, Lai-Him, 15:3944
McNeill, J.H., The study of exotic $N \simeq 82$ nuclei using the Daresbury recoil mass separator, 15:4101 (R;US)

McPheeters, C.C., *See* Dees, D.W., 15:2654, 15:2655
McSorley, J.A., *See* Watts, R.R., 15:3440
McVeety, B.D., *See* Cataldo, D.A., 15:3463
McVeigh, J., *See* Catalano, A.W., 15:2304
McVey, B.D., *See* Goldstein, J.C., 15:3159, 15:3298
Mcvey, J.B., Application of advanced diagnostics to airblast injector flows, 15:3198 (RA;US)
McVoy, K.W., *See* Fricke, S.H., 15:4166
Meadows, J.W., Intercomparison of U-238 deposits employed for neutron fluence determination in neutron activation cross section measurements, 15:4111 (R;US)
Meakin, P., *See* Li, G., 15:2880
Means, K.H., *See* Clark, N.N., 15:2057
Measday, D.F., *See* Whitehouse, D.A., 15:3971
Mecherikoff, M., *See* Kaplan, B., 15:4514
Medley, S.S., *See* Zweben, S.J., 15:4383
Medvedev, V.N., Modifying action of gaseous hypoxia in radiotherapy of pulmonary cancer, 15:3668 (RA;SU;In Russian)
Mehlhorn, T.A., *See* Ruiz, C.L., 15:3311
Mehta, N.K., *See* Nambi, K.S.V., 15:4183
Meier, A., *See* Goldman, C.A., 15:2624
Meier, W.R., *See* Tobin, M.T., 15:4449
Meijer, S., On the usefulness of surface pressure calculations with a panel method for wind turbines, 15:2374 (RA;DK)
Melrovitch, H., Surface exponents of trails in two dimensions at tricriticality: Computer simulation study, 15:3016 (J;US)
Meisels, G.G., *See* Nishimura, T., 15:3085
Meister, J.P., Mechanics of materials model, 15:3240 (RA;US)
Mejon-Goula, M.J., *See* Van Kote, F., 15:2197
Melack, J.M., *See* Sickman, J.O., 15:3552
Melendres, C.A., Raman spectroscopy of nanophase TiO_2, 15:2946 (J;US)
Melke, J., Determination of compatibility conditions of the burner/boiler system of heating equipment with a view to energy conservation by means of optimum adjustment of components. Final report. Pt. 3. Investigations of pressure swings in the starting process in a burner/boiler system, 15:3235 (R;DE;In German)
Mellinger, G.B., *See* Knox, C.A., 15:2440
Melo, M.V.M.C. de, Cholesteric lyomesophases based on sodium N-lauroyl asparte: characterization of new system by nuclear magnetic resonance and polarizing microscopy, 15:3076 (R;BR;In Portuguese)
Melson, G.A., Sulfur dioxide removal from flue gases by supported copper and iron absorbents: Final technical report, May 16, 1986-December 31, 1988, 15:2068 (R;US)
Melton, J.G., *See* Reass, W.A., 15:4436
Meng, L., Electron removal from molecular hydrogen by fully stripped ions at intermediate energies, 15:3919 (J;US)
Menicucci, D., The economic potential of a photovoltaic central receiver power plant, 15:2322 (BA;US)
Menlove, H.O., Determination of U-235 quantity in non-irradiated nuclear fuels using the neutrons coincidence method, 15:2168 (R;BR;In Portuguese)
See Hsue, S.-T., 15:2246
Mensch, A., WES, a robust expert system for well test analysis, 15:2105 (R;US)
Menten, J.O.M., Bud irradiation to obtain resistence to citrus canker through induction of mutation, 15:3686 (R;BR;In Portuguese)
Menzer, R., *See* Nouvel, P., 15:4517
Merkle, J.G., Engineering approaches to the application of fracture toughness data in the nuclear industry, 15:2820 (R;US)
[Integrity of pressure components of nuclear power plants]: Foreign trip report, October 3, 1989–October 20, 1989, 15:2553 (R;US)
Merkle, K.L., Atomic matching across internal interfaces, 15:4207 (R;US)
See Wachs, A.L., 15:4258
Merriman, J.R., *See* Anderson, T.D., 15:2610
Merten, G.P., Operation and performance of commercial cool storage systems: Volume 1, 1987 cooling season, 15:2564 (R;US)
Operation and performance of commercial cool storage systems: Volume 2, 1988 cooling season and project summary, 15:2565 (R;US)
Mertens, G., *See* Reiner, K., 15:4085
Merts, A.L., *See* Collins, L.A., 15:3930
Merzbacher, C.I., *See* Bourcier, W.L., 15:2240
Meseguer, J., *See* Goguen, J.A., 15:4500
Meshii, M., *See* Koike, J., 15:2858, 15:2873
Messier, D.R., Y-Si-Al-O-N glass fibers. Final report, 15:2967 (R;US)
Messing, G.L., *See* Pollinger, J.P., 15:2938
Metag, V., *See* Breitbach, G., 15:4105
See Hennrich, H.J., 15:4095
See Thirolf, P., 15:4102
Metcalf, W., *See* Chan, Lai-Him, 15:3944
Methfessel, S., *See* Rossowsky, R., 15:3121
Mett, R.R., Current drive via magnetohydrodynamic helicity waves, 15:3940 (J;US)
Meuzelaar, H.L.C., *See* Yeh, G.J.C., 15:2062
Mewaldt, R.A., Elemental composition and energy spectra of galactic cosmic rays, 15:3861 (RA;US)
Toward a descriptive model of galactic cosmic rays in the heliosphere, 15:3852 (RA;US)
Mewes, D., Critical investigations and model development on countercurrent flow of gas and liquid in horizontal and vertical channels. Final report, 15:2530 (R;DE;In German)
Mextorf, O., *See* Zeuner, G., 15:3392
Meyer, B., *See* Holstein, P.A., 15:4386
Meyer, E., *See* Cooke, D.W., 15:3128
Meyer, H., *See* Krisch, A.D., 15:3281
Meyer, K., Experimental and theoretical investigation of passive use of solar energy on house facades, 15:2676 (R;DE;In German)
Meyer, P., *See* Weathersby, P.K., 15:3614
Meyer, T.G., High temperature constitutive and crack initiation modeling of coated single crystal superalloys, 15:2845 (RA;US)
Meyer, W.H., *See* Butner, D.N., 15:4358
Meyers, S., *See* Ketoff, A., 15:2646
Meyers, S.C., Recovery of metals using aluminum displacement, 15:2741 (R;US)
Mezrahi, A., Safety in transport and storage of radioactive materials, 15:2172 (R;BR;In Portuguese)
Micca, P., *See* Coderre, J.A., 15:3615
Michael, G., *See* May, B., 15:2278
Michael, J.V., Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)
Michaels, A.I., *See* Nichols, F.A., 15:3214
Michalsky, J.J., Beyond the IDMY [International Daylighting Measurements Year]: A network instrument for low-cost data acquisition, 15:2699 (R;US)
Michelis, J., Investigation of explosion with delayed start ($\geq$ 150 m) and methods of prevention. Final report, 15:2104 (R;DE;In German)
Michishita, Toshinori, Efficiency of current drive by pulsed injection of REB, 15:4335 (RA;JP)
Mickelson, M.L., Radiological Sciences Department Annual report: Research and development, Fiscal year 1955, 15:3504 (R;US)
Mickley, G.A., Enhanced acoustic startle responding in rats with radiation-induced hippocampal granule cell hypoplasia, 15:3692 (R;US)
Midorikawa, Sholchi., Double-periodic wormholes in theories with global symmetries, 15:4020 (R;JP)
Mieden, O.J., The reactions of peptide peroxyl radicals in aqueous solution, 15:3732 (RA;DE)
Miesenboeck, H.M., Electron correlations and dielectric screening in a layered electron gas, 15:4219 (R;XA)
Mignaco, J.A., *See* Linhares, C.A., 15:4032
Mihailidis, D., *See* Hintz, N.M., 15:4064
Mihalczo, J.T., Subcriticality of two uranyl nitrate slab tanks spaced in air by the ^{252}CF-source-driven noise analysis method, 15:3125 (R;US)
Miknis, F.P., A solid-state NMR study of condensation/retrograde reactions during coal liquefaction: Quarterly progress report, July 1–September 30, 1989, 15:2023 (R;US)
Miley, G.H., *See* Ho, S.K., 15:4381
See Varadarajan, V., 15:4302, 15:4398
Milian, L.W., *See* Czajkowski, C.J., 15:2457
Miller, J.D., Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication, 15:3684 (R;US)
Miller, B.A., *See* Blevins, R.P., 15:2645

Miller, C.M., *See* Fearey, B.L., 15:3905
Miller, D.A., *See* Chiang, T.C., 15:3583
Miller, D.L., *See* Bauer, W.F., 15:3609
Miller, D.P., The architectural ergonomics of Sandia's RHIC-II growing facility, 15:3229 (BA;US)
Miller, D.R., *See* Dravid, N.V., 15:2416
Miller, F.J., *See* Grose, E.C., 15:3781
Miller, G.A., The b_1 structure function and nuclear pions, 15:4126 (R;US)
Miller, H.G., *See* Davis, E.D., 15:4283
Miller, J.F, *See* Marr, W.W., 15:2583
See Patil, P.G., 15:2584
Miller, J.F., *See* DeLuca, W.H., 15:2574
Miller, J.M., *See* Lousteau, D.C., 15:4387
Miller, J.P., *See* Whitehouse, D.A., 15:3971
Miller, J.R., *See* Kerns, J.A., 15:4472
See Shen, S.S., 15:4446
See Summers, L.T., 15:4473
Miller, M., *See* Azevedo, S.G., 15:4530
Miller, P.A., Image-projection ion-beam lithography, 15:3906 (J;US)
Miller, P.B., Model validation: Cooling-tower performance: Final report, 15:2415 (R;US)
Miller, R.A., *See* Chang, G.C., 15:2924
See van der Heijde, P.K.M., 15:3557
Miller, R.J.D., *See* Kasinski, J.J., 15:4238
Miller, R.L., *See* Baldwin, R.M., 15:2022
See Krakowski, R.A., 15:4342
Miller, W.H., Quantum mechanical reactive scattering theory for simple chemical reactions: Recent developments in methodology and applications, 15:3077 (R;US)
Some new theoretical methods for treating reaction dynamics in polyatomic molecular systems, 15:3079 (R;US)
See Makri, N., 15:3086
Mills, A.L., *See* Gunnison, D., 15:3543
Mills, D.L., *See* Hall, B., 15:2888
Mills, D.M., *See* Buschert, J.R., 15:3017
See Larson, B.C., 15:2999
Milne, A.M., *See* Blakers, A.W., 15:2318
Milonni, P.W., Fluorescence near a phase-conjugating mirror: Amplification of quantum noise, 15:3929 (J;US)
Natural line shape, 15:3922 (J;US)
Milora, S.L., *See* Combs, S.K., 15:4396
See Gouge, M.J., 15:4388
Miltner, R.J., *See* Stevens, A.A., 15:3556
Mims, J., Survivable pulse power space radiator, 15:2494 (P;US)
Min, B.J., First-principles total-energy calculations on Y and α-$YH_{0.5}$, 15:2889 (J;US)
Minajlo, T.I. and others, *See* Demidchik, E.N., 15:3641
Miner, G.E., High volume processing of point contact solar cells, 15:2315 (BA;US)
Ming, D.W., Zeolites on Mars: Possible environmental indicators in soils and sediments, 15:3835 (RA;US)
Minkin, S.C., *See* McElroy, D.L., 15:2186
Minkov, V., Evaluation of fuel cell technologies for electric utility applications, 15:2758 (R;US)
Minotti, F., *See* Diez, J.A., 15:4273
Minty, M.G., *See* Krisch, A.D., 15:3281
Miranda, F.A., Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)
Mirandi, L.E.T., *See* Brandao Filho, D., 15:2169
Mirels, H., Multiline multimode c-w (continuous-wave) chemical laser performance. Technical report, 15:3142 (R;US)
See Bernard, J.M., 15:3149
Mironova, G.I., *See* Risin, S.A., 15:3652
Miroshnichenko, V.F., Thermodynamic principles of the process of the effect of electromagnetic fields on a polymer melt, 15:3799 (R;US)
Mirtich, M.J., *See* Swec, D.M., 15:2929
Mischke, R.E., *See* Oothoudt, M.A., 15:3297
Mishra, S.C., Construction of second constant of motion for two dimensional classical super systems, 15:4263 (R;XA)
Mishra, V., *See* Mishra, S.C., 15:4263
Misilo, S., *See* Ginsberg, A.P., 15:2558
Mitchell, A.W., *See* Schlesinger, Z., 15:2958
See Zasadzinski, J.F., 15:4254
Mitchell, C.S., *See* Shinn, J.H., 15:3468
Mitchell, G.D., *See* Davis, A., 15:2026
Mitchell, R.L., *See* Ullal, H.S., 15:2308
Mitchell, T.E., *See* Roy, T., 15:2922
Mito, T., *See* Shintomi, T., 15:3296
Mitsui, Hiroshi, Radiation resistance of solar cells for space application, 1. Study on the irradiation procedure of electron beams, 15:2294 (R;JP;In Japanese)
Mittelstaedt, W., *See* Steffens, W., 15:3506
Mittleman, M.H., *See* Bardsley, J.N., 15:4384
Miura, Yukitoshi, Low energy neutral particle energy analyser by time of flight method, 15:4420 (R;JP;In Japanese)
Miyahara, A., Proceedings of the Japan-U.S. workshop P-118 on vacuum technologies for fusion devices, 15:4419 (R;JP)
Miyahara, K., Static leaching of actinides and fission products from fully radioactive waste glass of HLLW generated in Tokai reprocessing plant, 15:2224 (R;JP)
Miyamoto, A., *See* Coutinho, M. de F.F., 15:3475
Miyasato, S., *See* Sunwoo, A.J., 15:2840
Miyo, Yasuhiko, *See* Hiratsuka, Hajime, 15:4423
Miyoshi, N., *See* Matsumoto, S., 15:2795
Mizuno, Y., *See* Alberich, T., 15:3956
Mizuuchi, T., Study on edge plasma physics and particle control in the Heliotron E device, 15:4343 (R;JP)
Mizuuchi, T. and others, *See* Zushi, H., 15:4344
Mladsi, S.W., *See* Ellis, J.R., 15:2844
Mo, S.C., Conversion feasibility studies for the Grenoble high flux reactor, 15:2458 (R;US)
Mobbs, S.F., Disposal into the sub-seabed, 15:2199 (R;FR)
Mode, V.A., Environmental considerations for the conduct of surrogate tests in the Engineering Demonstration System, 15:3791 (R;US)
Modera, M.P., *See* Fisk, W.J., 15:2691
Modine, F.A., *See* Jellison, G.E. Jr., 15:3376
Modro, S.M., Review of LOFT [Loss-of-Fluid Test] large break experiments: OECD LOFT project, 15:2551 (R;US)
Moed, B.A., *See* Nazaroff, W.W., 15:2688
Moegel, P., *See* Burkert, E., 15:3347
Moehler, O., *See* Arnold, F., 15:3350
Moeller Andersen, F., HERMES-model for Denmark, 15:4525 (R;DK)
Moeller, C.P., *See* Hoffmann, E.H., 15:4407
Moeller, E., Development of a container for pumps, measuring equipment and motorgenerators in connection with a bioconversion energy system, 15:2297 (R;DK;In Danish)
Moeller, K.D., *See* Williams, G.P., 15:3283
Mofiz, U.A., Wakefield accelerator in a magnetized electron-positron plasma, 15:3262 (R;XA)
Mohamad Azmi bin Ismail., *See* Yahaya bin Jafar, 15:2257
Mohamad bin Harun, Effect of heat treatment of toughness and strength properties of C-Mn steel, 15:2850 (R;MY)
Mohamad Hilmi bin Mahmoo, Electron beam (EB) curing of wood surface finishing - lamination of PVC film on wood substrates. Final report STA scientist exchange program JAERI, Takasaki, Japan (September to November 1988), 15:2256 (R;MY)
Synthesis of acrylated urethane oligomer, 15:3080 (R;MY)
See Dahlan bin Haji Mohd, 15:2255
See Hussin bin Mohd Nor, 15:2983, 15:2984
Mohanty, K.M., *See* Bloch, J.M., 15:3030
Mohr, C.M., *See* Leeper, S.A., 15:2728
Mohr, D., *See* Planchon, H.P., 15:2500
Moitta, L.P.M., *See* Menlove, H.O., 15:2168
Moi, A., *See* Brand, R.A., 15:2702, 15:2703
Molak, V., *See* Bruins, R.J.F., 15:2775
Molecke, M.A., *See* Argueello, J.G., 15:2235
Moller, J.M., *See* Butner, D.N., 15:4358
Monaghan, R., *See* Carroll, A., 15:3269
Monazl', G.D., Radiation injuries following repeated irradiation by mean dose fractionating of multiple bone metastases of breast cancer, 15:3740 (RA;SU;In Russian)
Moncton, D.E., Overview of the advanced photon source, 15:3318 (R;US)
Mongia, H.C., *See* Karki, K.C., 15:3196

See Nikjooy, M., 15:3197
Monkhorst, H.J., *See* Szalewicz, K., 15:4175
Montalvo, E., OHMIC ignition in a single-turn-coil Tokamak (IGNITEX), 15:4457 (BA;US)
Montgomerie, B., Performance methods (again—), 15:2368 (RA;DK)
Montgomery, R.O., *See* Billone, M.C., 15:2504
Montopoli, M., Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)
Monzul', G.D., Radiation changes following treatment of inoperable locally disseminated mammary gland neoplasms when using proton beams, 15:3675 (RA;SU;In Russian)
Mook, H.A. Jr., [Dynamics of magnetic fluctuations in high-T_c materials]: Foreign trip report, October 5–October 15, 1989, 15:4257 (R;US)
Mooney, J., *See* Ginsberg, A.P., 15:2558
Moons, A.M.M., *See* Van der Wal, J.F., 15:2704
Moore, E.F., Observation of superdeformation in ^{191}Hg, 15:4107 (R;US)
Moore, G.E., *See* Morris, R.E., 15:3453
Moore, L.A., *See* Stevens, A.A., 15:3556
Moore, M.A., The suppression of stimulated hyper-Raman emission in Na due to parametric four-wave mixing, 15:3176 (J;US)
Moorhead, A.J., *See* Kim, Hyoun-Ee, 15:2912
Moorhead, P.E., Structural response of an advanced combustor liner: Test and analysis, 15:3245 (RA;US)
Moraski, R.V., *See* Falco, J.W., 15:3772, 15:3773
Mordfin, L., NDE (non-destructive evaluation) publications, 1985, 15:3217 (R;US)
More, V.D., *See* Green, M.A., 15:3299
Moreira, M.C.F., Radiological survey of Goiania by a mobile monitoring unit, 15:4186 (R;BR)
Morel, J.E., *See* Lorence, L.J. Jr., 15:2474, 15:3894
Moreland, J., Break junction measurement of the tunneling gap of a thallium-based high-temperature superconductor crystal, 15:2950 (J;US)
Moretto, L.G., Binary complex fragment emission and multifragmentation from very hot nuclei, 15:4099 (R;US)
Morgan, B., *See* May, B., 15:2278
Morgan, J.D. III, *See* Szalewicz, K., 15:4175
Morgan, L.G., *See* Haerer, H.A., 15:3749
Morgan, M.S., *See* Frank, R., 15:3787
Morgan, T.J., *See* Bernstein, E.M., 15:3926
Mori, S., Tracking performance evaluation. Final report, 1 December 1987-31 August 1988, 15:3379 (R;US)
Mori, W.B., *See* Umstadter, D., 15:4353
See Wilks, S.C., 15:3279
Moriarty, J.A., First-principles interatomic potentials in transition metals: Multi-ion interactions and their analytic representation, 15:4236 (R;US)
Morimoto, S., Second harmonic electron cyclotron heating in low and over density plasmas in Heliotron DR, 15:4347 (R;JP)
Morita, S., *See* Sakurai, M., 15:4318
Moriyama, S., *See* Itoh, S., 15:4418
Morosin, B., *See* Moreland, J., 15:2950
Moroz, Z., *See* Becker, K., 15:4097, 15:4136
See Reich, H., 15:3290
Morris, C., *See* Cooke, D.W., 15:3128
Morris, F.W., Detection of fine pore structures in graphite by impregnation with Wood's metal, 15:2978 (R;GB)
Morris, J., *See* Ayra, R.R., 15:2305
See Catalano, A.W., 15:2304
Morris, J.W. Jr., *See* Sunwoo, A.J., 15:2840
Morris, R.E., Sensitivity of a regional oxidant model to variations in climate parameters. Volume 1 and 2. Final report, 15:3453 (R;US)
Morris, R.V., What ferric oxide/oxyhydroxide phases are present on Mars, 15:3836 (RA;US)
Morris, V.R., *See* Connell, J.R., 15:2388
Morrison, P.J., Free-energy expressions for Vlasov equilibria, 15:4385 (J;US)
The free energy of Maxwell-Vlasov equilibria, 15:4309 (R;US)
Morrow, N.R., Rock matrix and fracture analysis of flow in western tight gas sands: 1988 annual report (Phase 4). Report for 30 December 1987-31 March 1989, 15:2146 (R;US)
Morse, S., *See* Kessler, T.J., 15:4370
Morsi, B.I., Coal surface control for advanced physical fine coal cleaning technologies: Quarterly report, May 1–July 31, 1989, 15:2015 (R;US)
Mortazavi, P., Mechanical design of SXLS [Superconducting X-ray Lithography Source] radio-frequency cavity, 15:3284 (R;US)
Mortenson, D.C., Geographic information system documentation of watershed data for Direct/Delayed Response Project. Southern Blue Ridge Province data base, 15:3553 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Northeast data base, 15:3555 (R;US)
Moser, R. D., *See* Ho, C. M., 15:3204
Moses, G.A., Design studies of the APEX light ion fusion experiment, 15:4461 (BA;US)
See Olson, R.E., 15:4477
See Yasar, O., 15:2557
Moses, R.W., *See* Yavornik, E.J., 15:4460
Moshfegh, B., Some heat transfer problems with phase change processes. Numerical and experimental analysis, 15:3191 (R;SE)
Moslehi, B., Fiber-optic wavelength-division multiplexing and demultiplexing using volume holographic gratings, 15:3373 (J;US)
Mosley, R.B., Application of radon reduction methods (revised), 15:3484 (R;US)
Moss, R.D., The TVA moving-manifold targeted-chlorination system: Second field demonstration: Final report, 15:2413 (R;US)
Mosteller, R.D., ARMP-02 documentation: Part 2, Chapter 5, EPRI-PRESS computer code manuals: Volume 1, Theory and numerics, 15:2525 (R;US)
Motojima, O., Biased limiter experiment in the Heliotron E device, 15:4441 (R;JP)
Moudgil, B.M., A new approach in ultrapurification of coal by selective flocculation: Annual report, 15:2024 (R;US)
Mounce, J.M., Revised manual for planning, designing, and operating transitway facilities in Texas. Research report, September 1983-August 1988 (Final), 15:2711 (R;US)
Mount, D.I., Methods for aquatic toxicity-identification evaluations. Phase 3. Toxicity confirmation procedures. Technical report, 15:3549 (R;US)
Methods for aquatic toxicity-identification evaluations. Phase 2. Toxicity identification procedures. Technical report, 15:3550 (R;US)
Mourgues, F., Magnetic microtearing coherence in tokamak plasmas, 15:4311 (R;FR;In French)
Mours, B., *See* Atwood, W.B., 15:3966
Moxhay, P., *See* Doncheski, M.A., 15:4015
Mpitsos, G.J., Parallel processing and learning in simple systems. Final report, 10 January 1986-14 January 1989, 15:3595 (R;US)
Mrig, L.C., Useful life prediction for first generation a-Si photovoltaic modules using outdoor test data, 15:2312 (BA;US)
Mueckler, P., *See* Arnold, F., 15:3350
Muehry, H., *See* Baur, G., 15:4077
Mueller, A., Compound elastic enhancement, 15:4146 (RA;DE)
See Alberich, T., 15:3956
See Baumann, W., 15:3890
Mueller, A.H., *See* Carlitz, R.D., 15:3972
Mueller, B., *See* Alberich, T., 15:3956
Mueller, G., *See* Behar, M., 15:4227
Mueller, S., *See* Zeuner, G., 15:3392
Muench, H.S., Assessment of global atmospheric effects of a major nuclear conflict. Final report, 1 February 1984-31 May 1987, 15:3474 (R;US)
Muffler, R., *See* Brucker, A., 15:4109
Mugikura, Yoshihior, *See* Watanabe, Takao, 15:2656
Mukaiyama, Takehiko, *See* Takizuka, Takakazu, 15:2471
Mukherjee, G., *See* Sharma, S.K., 15:4133
Mullen, E.G., Space radiation environment at 840 km, 15:3881 (R;US)
Muller, A., Electron-impact ionization of La^{q+} ions (q=1,2,3), 15:3917 (J;US)
Muller, B., Muon spectrum and convoy effects after muon-catalyzed fusion, 15:4177 (J;US)
Mulliner, M., *See* Zhao, G., 15:2892
Munekata, H., *See* Woronick, S.C., 15:3018
Munk Pedersen, J., *See* Bryder, K.L., 15:2761
Munro, J.K. Jr., *See* Hartmann, F.X., 15:3173

Munshi, M.Z., *See* Scrosati, B., 15:2567
Munson, D.E., Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 15:2233 (R;US)
Murakami, M., *See* Harris, J.H., 15:4372
Muralidhara, S., *See* Dallas, C.E., 15:3757
Murata, Y., Effects of gamma radiation on Crotalus durissus terrificus venom, 15:3696 (R;BR;In Portuguese)
Muravskaya, G.V., 15-th experience on application of non-standard dose fractionating in radiotherapy of patients with lung carcinoma, 15:3648 (RA;SU;In Russian)
Potentialities of 100 per cent objective effect receiving during chemoradiation therapy of patients with small cell lung carcinoma, 15:3649 (RA;SU;In Russian)
See Shevko, V.A., 15:3665
Murison, G., Induction of sister chromatid exchanges by direct and indirect chemical agents in a human teratoma cell line, 15:3608 (R;US)
Murphy, E.S., Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report, 15:2195 (R;US)
Murray, K., *See* Orth, C.D., 15:4475
Murray, K.A., The Gevaltig: An inertial fusion powered manned spacecraft design for outer solar system missions, 15:2710 (R;US)
Murray, W., *See* Forsgren, A.L., 15:4546, 15:4547
Murray, W.E., *See* Hunt, W.A., 15:3756
Murter, J.S., *See* Larson, T.K., 15:4515
Murthy, J.Y., *See* Habib, H.M., 15:2336
Murthy, P. L. N., *See* Chamis, C. C., 15:2976
Murthy, S.N.B., *See* Nikjooy, M., 15:3197
Mus, V.F., Quality garantee of radiotherapy of patients with lung cancer, 15:3650 (RA;SU;In Russian)
See Simbirtseva, L.P., 15:3654
Musaelyan, R.M., Neutron cross sections of tin and cadmium isotopes in the range of 0.5-2.0 MeV, 15:4098 (RA;SU;In Russian)
Musina, R., On the continuity of the Nemitsky operator induced by a Lipschitz continuous map, 15:4281 (R;XA)
See Chen Yunmei, 15:4282
Musselman, R.C., *See* Bytnerowicz, A., 15:3446
Muther, H., *See* Jiang, M.F., 15:4174
Muto, K., Calculation of 2ν double beta decay of ^{76}Ge, ^{82}Se, ^{128,130}Te, 15:4137 (RA;DE)
Proton-neutron quasiparticle RPA and charge-changing transitions, 15:4138 (RA;DE)
See Bender, E., 15:4139
Myall, J.O., *See* Summers, L.T., 15:4473
Myer, L.R., *See* Majer, E.L., 15:3812
Myers, P.S., Ceramics for transportation engines - siren or solution, 15:2782 (R;US)
Myers, W.D., Looking for precursors of neutron matter exotica, 15:4161 (R;US)
Myles, K.M., *See* Redey, L., 15:2575
Mynatt, F.R., *See* Anderson, T.D., 15:2610
Mynatt, J.O., *See* Cottrell, W.D., 15:3508
Myra, J.R., *See* Aamodt, R.E., 15:4307

N

Naal, Z., Electrochemistry of pentaamminruthenium (II) complexes with cyanopyridinium ions, 15:3053 (R;BR;In Portuguese)
Naccach, D., X and UV time resolving diagnostics for X-ray laser experiments, 15:4369 (BA;US)
Nachtwey, D.S., *See* Shea, M.A., 15:3851
Nafari, N., *See* Ziesche, P., 15:4220
Nagae, T., *See* Shintomi, T., 15:3296
Nagano, Shosaburo, *See* Saito, Toshio, 15:2972
Nagao, A., *See* Itoh, S., 15:4418
Nagase, K., Fuel-injected system for diesel engines with injection pressure control, 15:2787 (R;JP)
Nagle, D.P., Molecular biology and physiology of methanogenic archaebacteria. Annual report, July 1988-June 1989, 15:3596 (R;US)
Nair, V., *See* Csencsits, R., 15:2989
Najmabadi, F., *See* Hasan, M.Z., 15:4468
See Sharafat, S., 15:4470
Nakagome, Yoshihiro, Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1988, 15:4159 (R;JP;In Japanese)
Nakajima, T., *See* Osaka, T., 15:2570
Nakamura, A., Universe as a topological defect in a higher-dimensional Einstein-Yang-Mills theory, 15:3827 (R;JP)
Nakamura, Hiroyuki, *See* Koori, Norihiko, 15:4427
Nakamura, K., *See* Itoh, S., 15:4418
Nakamura, Takehiko, Review on fission product source term from fuel at severe accident conditions, chemical forms and release rates, 15:2534 (R;JP;In Japanese)
Nakamura, Y., STEP code improvements and extensions, 15:4346 (R;JP)
See Itoh, S., 15:4418
Nakao, Ken-ichi., *See* Hosoya, Akio, 15:4287
Nakashima, Takao, *See* Koori, Norihiko, 15:4427
Nakazawa, Naohito., Extended local gauge invariance and the BRS symmetry in stochastic quantization of gauge fields, 15:4043 (R;JP)
Namavar, F., *See* Tan, Z., 15:3028
Nambi, K.S.V., Environmental radiation levels in and around Kalpakkam during 1983-1987, 15:4183 (R;IN)
Natural background radiation and population dose distribution in India, 15:4190 (R;IN)
See Sankaran, A.V., 15:3505
Nann, H., *See* Segel, R.E., 15:4081
Nanstad, R.K., A computer-controlled automated test system for fatigue and fracture testing, 15:3215 (R;US)
See Alexander, D.J., 15:4397
Naoi, K., Cell performance of ultra-thin polymer-cathode system: Theoretical energy and power-density projections. Technical report No. 3, July 1988-June 1989, 15:2568 (R;US)
Impedance analysis of ionic transport in polypyrrole-polyazulene copolymer and its charge-discharge characteristics. Technical report, July 1988-June 1989, 15:2571 (R;US)
Napier, B.A., Hanford environmental dose reconstruction project: Technical approach, 15:3750 (R;US)
See Haerer, H.A., 15:3749
Narasimhan, T.N., *See* Fisk, W.J., 15:2691
Narayan, J., *See* Ganapathi, L., 15:2949
See Singh, R.K., 15:2943
Narayanan, T.V., Structural integrity studies of an external direct absorption solar central receiver, 15:2329 (BA;US)
Narayanasamy, A., *See* Melendres, C.A., 15:2946
Narten, A.H., *See* Habenschuss, A., 15:3088
Naruse, Y., *See* Sze, D.K., 15:4393
Nascimento, M., *See* Borghi, V.C., 15:3621, 15:3623
Nascimento, V.F., *See* Armelin, M.J.A., 15:3048
Nash, A.S., The effect of composition and processing on high T_c superconductors containing bismuth, 15:2909 (R;US)
Nash, M., *See* Wierenga, P.J., 15:2218
Nashiyama, Isamu, *See* Itoh, Hisayoshi, 15:2920
Nastasi, M., *See* Jervis, T.R., 15:2866
Natesan, K., *See* Sethi, V.K., 15:2093
Natowitz, J.B., *See* Viesti, G., 15:4091
Naumenko, A.Z., Method of plotting the scintigrams of high information value, 15:3635 (RA;SU;In Russian)
Naveh, N., *See* Belkin, M., 15:3797
Nazaroff, W.W., Factors influencing soil as a source of indoor radon: Framework for assessing radon source potential, 15:2688 (R;US)
Nebbia, G., *See* Viesti, G., 15:4091
Nebenzahl, I., *See* Tzach, D., 15:4363
Neff, J.M., *See* Maciolek-Blake, N., 15:2130, 15:2131
Nehnevajsa, J., Volunteering for emergency preparedness. Final report, March 1988-March 1989, 15:4550 (R;US)
Nelson, A.J., *See* Cooper, C.A., 15:3123
Neitzel, D.A., Survey of Columbia River Basin streams for giant Columbia River spire snail Fluminicola columbiana and great Columbia River limpet Fisherola nuttalli, 15:3541 (R;US)
Nellen, L., *See* Bordes, J., 15:4045
Nelson, A.J., *See* Berry, W.B., 15:2310

Nelson, B.E., *See* Lousteau, D.C., 15:4387
Nelson, D.C., The continuing saga of alpha CAM [continuous air monitor] development at Los Alamos, 15:3482 (R;US)
Nelson, D.L., *See* Caskey, C.T., 15:3603
Nelson, J.S., *See* Baskes, M.I., 15:3024
Nelson, P., *See* Ayoubi, I.S., 15:3473
Nelson, R.F., Improved operational performance of the Shenandoah Solar Total Energy Project, 15:2325 (BA;US)
Nelson, R.S., Creep fatigue life prediction for engine hot section materials (ISOTROPIC) fifth year progress review, 15:3247 (RA;US)
Nelson, W.H., Radiation chemistry of adenine derivatives following direct ionization in solids: ESR and ENDOR investigations, 15:3716 (RA;DE)
See Close, D.M., 15:3708
See Hole, E.O., 15:3712
See Sagstuen, E., 15:3717
Nelson, W.R., *See* Hahn, H.A., 15:2480
Nero, A.V., *See* Nazaroff, W.W., 15:2688
Nestor, J., *See* Wegner, P., 15:4526
Netto, A.L., Radiological protection. Responsibility of the Safety Engineering Company, 15:4188 (R;BR;In Portuguese)
Neumann, J.F., *See* Strangman, T.E., 15:2925
Neumann, P., *See* Winkelmann, I., 15:3746
Neumann, R., *See* Arnold, W., 15:3321
See Baumann, W., 15:3293, 15:3294, 15:3345, 15:3889, 15:3890
Neumann-Cosel, P. von, *See* Bellm, D., 15:4086
Neurgaonkar, R.R., Growth of tungsten bronze family crystals. Final technical report, 6 May 1985-30 November 1988, 15:2809 (R;US)
Neuvonen, I., *See* Hellsten, S., 15:2287
Newman, H., *See* Cukauskas, E., 15:3233
Newman, M., *See* Chocol, C., 15:4488
Newnam, B.E., *See* Goldstein, J.C., 15:3159
Newton, J.L., *See* Carlson, D.E., 15:2303
See Catalano, A.W., 15:2304
Neyatani, Yuzuru, *See* Ozeki, Takahisa, 15:4425
Ng, J., *See* Moslehi, B., 15:3373
Nguyen, P.D., *See* Sierra Alcazar, H.B., 15:2579
Nguyen, V., Analysis of caisson transport experiments by travel time approach, 15:2201 (R;US)
See Dagan, G., 15:2202
Nicholas, W.D., *See* Summers, J.R., 15:3801
Nichols, F.A., The modeling of wear in energy conversion and utilization technologies: Proceedings, 15:3214 (R;US)
See Erdemir, A., 15:2906
Nicholson, R.L., *See* Vaught, C.C., 15:2747
Nicol, T.H., Structural performance of the first SSC [Superconducting Super Collider] Design B dipole magnet, 15:3287 (R;US)
Nicoli, D., *See* Coutinho, M. de F.F., 15:3475
Nielsen, R., *See* Kaufherr, N., 15:2818
Niemczyk, N., *See* Kissel, J., 15:3348, 15:3349
Niemeier, R.W., *See* Millar, J.D., 15:3684
Nies, A., *See* Storck, R., 15:2198
Nigg, D.W., *See* Parsons, D.K., 15:2490
Niktina, L.I., *See* Petukhov, V.N., 15:3628
Nikjooy, M., Aerothermal modeling program. Phase 2, element B: Flow interaction experiment, 15:3197 (RA;US)
Nikolaev, V.N., *See* Petukhov, V.N., 15:3628
Nikolaeva, D.V., Immediate results of concomitant radiotherapy of advanced forms of cervix uteri carcinoma with the use of thymaline, 15:3663 (RA;SU;In Russian)
Niksa, S., *See* Lau, Chun Wei, 15:2098
Nilsson, Aa., Mercury in lake fish. Linkages to mercury and selenium in mor and historical emissions, 15:3565 (R;SE;In Swedish)
Nirmalan, V., *See* Hylton, L.D., 15:3202
Nisenbaum, B.L., Comparative evaluation of efficiency of radiation and surgecal treatment of microinvasive cervix uteri carcinoma, 15:3651 (RA;SU;In Russian)
Nishimoto, Sei-ichi, *See* Kagiya, V.T., 15:3707
Nishimura, T., Bimodal kinetic energy release in the unimolecular dissociation of energy-selected formic acid ion, 15:3085 (J;US)
Nishioka, H., Partial level densities in precompound reactions, 15:4141 (RA;DE)
Statistical theory of precompound reactions: The multistep direct process, 15:4143 (RA;DE)
Nishioka, Tsuyoshi, Estimation of the one-loop mass shifts in open superstring theory, 15:4022 (R;JP)
Nissen, O.S., Electromagnetic flywheel energy storage for use in electric powered trucks and vehicles for domestic transport, 15:2561 (R;DK;In Danish)
Nissley, D.M., *See* Meyer, T.G., 15:2845
Niva, T., *See* Tikkanen, P., 15:2288
Niwa, Y., *See* Nishimura, T., 15:3085
Noble, A.J., *See* Whitehouse, D.A., 15:3971
Noda, A., *See* Arnold, W., 15:3321
Noda, N., *See* Zushi, H., 15:4344
Noda, Y., Lattice dynamics of quenched diffuse ω phase in $Zr_{0.8}Nb_{0.2}$, 15:2884 (J;US)
Nodulman, L.J., Hadron collider physics at Fermilab, 15:3260 (R;US)
Noerkaer Soerensen, J., Some physical and numerical aspects of wind turbine aerodynamics, 15:2366 (RA;DK)
Nold, D.W., Molecular dynamics of laser ablation of a polymer coating, 15:3002 (J;US)
See Hartmann, F.X., 15:3173
Noll, L.A., Ambient and high-temperature calorimetry of commercial surfactants: Project BE4A, Milestone 8, FY89 annual research plan, 15:2113 (R;US)
Nomachi, M., *See* Brueckner, W., 15:3955
Nonn, P., *See* Cho, M.H., 15:4364
Norberg, J.C., *See* Price, C.W., 15:2856
Norden, K., *See* Tichler, J., 15:2540
Nordley, G.D., Potential for a near-term very-low-energy antiproton source at Brookhaven Baticnal Laboratory. Special report, 15:3947 (R;US)
Norman, M.R., Fermi surface and effective masses for the heavy-electron superconductor UPt_3, 15:4248 (R;US)
Normark, P., *See* Ahlstroem, M., 15:2754
North, G.R., *See* Hyde, W.T., 15:3399
Northcutt, L.A., *See* Nichols, F.A., 15:3214
Nothnagel, E.A., *See* Thomson, W.W., 15:3601
Nouvel, P., Electronics for online and data acquisition, 15:4517 (RA;DE;In German)
Novotny, R., *See* Breitbach, G., 15:4105
See Hennrich, H.J., 15:4095
Novozhilov, V., *See* Bodyulkov, A., 15:3988
Nowak, E.J., The Waste Isolation Pilot Plant (WIPP) Seal System Performance Program, 15:2236 (R;US)
Nowicki, L.J., *See* Beno, M.A., 15:4249
Nozawa, S., Neutral pion photoproduction of the nucleon near threshold, 15:3977 (R;US)
Nuess, M., Northwest Residential Radon Standard: Volume 1, Project report, 15:2668 (R;US)
Northwest residential radon standard: Volume 2, Comment letters, 15:2669 (R;US)
Nunes, J., *See* Tsangarakis, N., 15:2966
Nunez, C.M., *See* Kosusko, M., 15:3439
See Ponder, W.H., 15:3450
Nuzum, T., *See* Fisk, W.J., 15:2691
Nygren, E., *See* Lu, G.Q., 15:2995
Nykaenen, M., *See* Hellsten, S., 15:2287
Nyman, D.H., *See* Gibson, M.W., 15:2171
Nyman, M., *See* Stover, R., 15:3280
Nyquist, G., *See* Vessely, V., 15:3467

O

O'Brien, D., *See* Montopoli, M., 15:3457
O'Brien, T.K., *See* Telschow, K.L., 15:2916
O'Connell, D.R., *See* Green, M.A., 15:3299
O'Dowd, J.G., *See* Ayra, R.R., 15:2305
See Carlson, D.E., 15:2303
O'Gallagher, J., Optical properties of one and two-stage concentrator systems with non-paraboloidal and non-axisymmetric primaries, 15:2348 (BA;US)
O'Hare, P.A.G., Standard molar enthalpies of formation and transition at 298.15 K and other thermodynamic properties of the crystalline and vitreous forms of arsenic sesquiselenide (As_2Se_3): Dissociation enthalpies of As-Se bonds, 15:2968 (R;US)

O'Loughlin, M.J., *See* Krantz, R.J., 15:3360
O'Neill, P., Pulse radiolysis of DNA - effects of environment, 15:3705 (RA;DE)
O'Rourke, P.J., Statistical properties and numerical implementation of a model for droplet dispersion in a turbulent gas, 15:3939 (J;US)
O'Rourke, T.D., Liquefaction hazards and their effects on buried pipelines. Technical report, 15:3254 (R;US)
Obenschain, S.P., Effects of laser beam smoothing on laser-plasma interaction, 15:4454 (BA;US)
Oberle, W., Electrothermal guns – a theoretical investigation of factors for optimal performance. Technical report, 15:2660 (R;US)
Oda, Hisako., *See* Kishimoto, Yasuaki, 15:4339, 15:4341
Odajima, Kazuo, *See* Kishimoto, Yasuaki, 15:4341
Odlenborg, R.C., *See* Finch, F.T., 15:2271
Oestergaard Jensen, S., Plastic foil absorbers for solar collectors, 15:2345 (R;DK;In Danish)
Oestergaard, K., *See* Dam-Johansen, K., 15:3419
Ogawa, Masuro, Heat and momentum transfer in a gas coolant flow through a circular pipe in a high temperature gas cooled reactor, 15:2453 (R;JP;In Japanese)
Ogawa, Toru, Estimation of thermodynamic properties of alloys from phase diagram and other loose boundary conditions, 15:2838 (R;JP;In Japanese)
See Takizuka, Takakazu, 15:2471
Ogbe, D.O., A correlation for interference testing with wellbore-storage and skin effects, 15:2116 (J;US)
Ogden, J.S., Characterisation of molecular boric acid by mass spectrometry and matrix isolation-infrared spectroscopy, 15:3068 (R;GB)
See Bowsher, B.R., 15:3069
Ogurek, K.H., *See* Preuss, W., 15:2435
Oh, C.H., Heat transfer in condensation of lithium vapors, 15:4404 (R;US)
Oh, D.J., *See* Johnson, R.A., 15:2876
Ohana, I., Lattice mode study of La_2CuO_{4-y} implanted with Sr, 15:2937 (BA;US)
Ohara, Y., *See* Inoue, T., 15:4439
Ohara, Yoshihiro, *See* Matsuoka, Mamoru, 15:4422
Ohkubo, Kunizo, Coupling analysis and experiment on fast wave antenna and multijunction grill for current drive, 15:4325 (RA;JP)
Ohlmann, J., *See* Sieber, K., 15:3713
Ohlms, N., The DESONOX flue gas purification process, 15:2427 (R;DE;In German)
Ohmann, L.F., Physical characteristics of study plots. Across-a-Lake States acidic-deposition gradient. Forest Service resource bulletin, 15:3455 (R;US)
Ohsugi, T., *See* Bertrand, C., 15:3331
Ohta, Kazuya, *See* Hiratsuka, Hajime, 15:4423
Oide, K., *See* Chen, P., 15:3277
Okamoto, Masao, Bootstrap currents in toroidal systems, 15:4336 (RA;JP)
Okamoto, P.R., Elastic instability during amorphization of intermetallic compounds by charged-particle beams, 15:2861 (BA;US)
See Ding, F.R., 15:2859
See Koike, J., 15:2873
Okamoto, Y., *See* Yang, X.Q., 15:3035
Okamoto, Yoshi, *See* Hale, P.D., 15:3600
Okamura, H., *See* Suda, T., 15:4074
Okano, Fuminori, *See* Miura, Yukitoshi, 15:4420
Okazaki, T., *See* Yoshioka, K., 15:4326
Okeanova, N.I., Peculiarities of testing and introduction into clinical practice of Selectron installation in Research Institute of Health Ministry of Byelorussian SSR, 15:3669 (RA;SU;In Russian)
Okken, P.A., Greenhouse gas emission coefficients from the energy system. Two methods to calculate national CO_2-e issions, 15:2599 (B;NL)
See Kram, T., 15:3470
Okubo, S., Further study of global gauge anomalies of simple groups, 15:4027 (J;US)
Okumura, Y., *See* Inoue, T., 15:4439
Okumura, Yoshikazu, Measurement of impurities in a volume produced H^- ion beam, 15:4426 (R;JP;In Japanese)
Okuno, K., *See* Sze, D.K., 15:4393
Oldfield, E., ^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)
Olesen H.R., *See* Berkowicz, R., 15:3420
Olinto, A.V., *See* Frieman, J.A., 15:3849
Oliveira Filho, D.S., *See* Hunt, J.G., 15:4187
Oliveira, A.R., *See* Valverde, N.J., 15:3698
Oliveira, L.F.S. de., Event tree for the Angra 1 big LOCA, 15:2447 (R;BR;In Portuguese)
Oliveira, M.A.S., Spectrophotometric investigation of addition compounds between neodymium (III) and europium (III) perchorates and hexafluorophosphate and cyclic ligants with two oxygen in opposite position, 15:3055 (R;BR;In Portuguese)
Olivier, M., *See* Van Kote, F., 15:2197
Oliut, M., *See* Lilja, R., 15:3251
Olmer, C., *See* Segel, R.E., 15:4081
Olness, F.I., Left-right symmetric electroweak models, 15:4017 (R;US)
When is a heavy quark not a parton? Charged Higgs production and heavy quark mass effects in the QCD-based parton model, 15:3983 (R;US)
Olsen, A., Development of a data-processing model for steady turbulent 3-D gas particle flow, 15:3110 (R;DK;In Danish, English)
Olsen, C.R., *See* Todd, J.F., 15:3490
Olsen, D.K., Use of amine oxide surfactants for chemical flooding EOR [enhanced oil recovery], 15:2112 (R;US)
Olson, J.M., Ultralow recombination velocity at $Ga_{0.5}In_{0.5}P$/GaAs heterointerfaces, 15:3005 (J;US)
Olson, R.E., Conceptual design of a 10-MJ driver for a high gain target development facility, 15:4476 (BA;US)
Conceptual design of a high gain target development facility, 15:4477 (BA;US)
See Meng, L., 15:3919
Olszyk, D.M., Maintain and operate California Air Resources Board field fumigation facility for experimental use. Final report, 17 December 1987-30 June 1989, 15:3435 (R;US)
See Bytnerowicz, A., 15:3446
Omae, Iwao., *See* Saito, Toshio, 15:2972
Omidi, N., Structure of slow magnetosonic shocks in low beta plasmas, 15:4371 (J;US)
Omori, E., *See* Kring, C.T., 15:2170
Onken, U., Desulfurization of industrial gaseous effluents. Final report, 15:2729 (R;DE;In German)
Oohara, Hiroshi, *See* Matsuoka, Mamoru, 15:4422
See Okumura, Yoshikazu, 15:4426
Oothoudt, M.A., Report from the workshop on computing directions and options for data acquisition and analysis at LAMPF [Los Alamos Meson Physics Facility], 15:3297 (R;US)
Ordonez, C., *See* Montalvo, E., 15:4457
Ordonez, C.R., Sewing relations and duality for BRST off-shell string tadpole amplitudes, 15:4009 (J;US)
Orient, G., *See* Cooke, P.I.H., 15:4469
See Hasan, M.Z., 15:4468
Orito, Kouichi, *See* Koori, Norihiko, 15:4427
Ornellas, D.L., *See* Tao, W.C., 15:3382
Oron, A., *See* Shapiro, M., 15:3402
Orr, L.H., *See* Briere, R.A., 15:4028
Orth, C.D., The VISTA spacecraft: Advantages of ICF for interplanetary fusion propulsion applications, 15:4475 (BA;US)
Wall ablation, gas dynamics, and the history of wall stresses in ICF target chambers, 15:4448 (R;US)
Ortiz, L.R.C., *See* Lima, M.I.C. de, 15:3044
Ortiz, M., *See* Demasi, J.T., 15:2927
Osaka, T., Rechargeable lithium/polymer cathode batteries. Technical report, July 1988-June 1989, 15:2570 (R;US)
See Naoi, K., 15:2571
Osakabe, Masahiro, *See* Hiraoka, Toru, 15:2462
Osakabe, Masahiro., *See* Takizuka, Takakazu, 15:2471
Oscarson, J.L., *See* Izatt, R.M., 15:2443, 15:2444
Oset, E., Pion induced double-charge exchange above the resonance, 15:4160 (R;US)
Osgood, R.M., Preliminary results from the fatigue testing of northern power systems 100KW wind turbine, 15:2405 (BA;US)
Osher, J.E., *See* Gathers, G.R., 15:3221
Osinski, M., *See* Park, J., 15:3180

Osman, R., Theoretical studies of molecular mechanisms of DNA damage induced by hydroxyl radicals, 15:3703 (RA;DE)
Ostlie, D.A., Nonlinear RR Lyrae models with time dependent convection, 15:3872 (BA;US)
See Cahn, J.H., 15:3871
Ostrowski, G.E., *See* Jorgensen, J.D., 15:3358
Oswald, R.S., *See* Ayra, R.R., 15:2305
See Carlson, D.E., 15:2303
Ott, K.C., *See* Shen, Z., 15:2960
Ott, R., *See* Goergner, D., 15:4196
Ott, W., *See* Reich, H., 15:3290
Otto, D.A., Electrophysiological systems for neurotoxicity field testing: PEARL II and alternatives, 15:3780 (R;US)
Ouchi, Hiroshi, Effects of environmental variables on fatigue crack growth rate in steel immersed in seawater, 15:2826 (R;JP)
Ousmane, M.A., *See* Cathat, C.L., 15:4158
Ovchinnikov, V.A., Chemoluminescence and antioxidative blood activity in patients with rectum cancer in radiotherapy, 15:3739 (RA;SU;In Russian)
Relationship of free CoA and long-chain Acyl-CoA in liver of animals after whole-body gamma irradiation, 15:3742 (RA;SU;In Russian)
Ovdienko, V.D., *See* Musaelyan, R.M., 15:4098
Overbey, W.K., Analysis of natural fractures observed by borehole video camera in a horizontal well, 15:2140 (BA;US)
Inducing multiple hydraulic fractures from a horizontal wellbore, 15:2147 (BA;US)
Overton, J.H., Estimating human-equivalent no observed adverse-effect levels for VOCs (volatile organic compounds) based on minimal knowledge of physiological parameters. Technical paper, 15:3783 (R;US)
Owens, B.B., Use of lithium batteries in biomedical devices. Technical report No. 8, July 1988-June 1989, 15:2569 (R;US)
See Naoi, K., 15:2568
See Osaka, T., 15:2570
See Scrosati, B., 15:2567
Owens, E.C., *See* Butler, W.E., 15:2122
Ozawa, M., *See* Matsumoto, S., 15:2795
Ozeki, Takahisa, ERATO-code analysis of vacuum magnetic field oscillations in JT-60 divertor configuration, 15:4425 (R;JP;In Japanese)

P

Paajala, J., Peat - Environment - Society. Part 2: Emissions from combustion of peat, 15:2073 (R;FI;In Finnish)
Pacyna, J.M., NO_X emissions from stationary sources in eastern Europe, 15:3421 (R;NO)
Pade, D., *See* Wile, J.L., 15:4100
Paesler-Sauer, J., *See* Fischer, F., 15:3481
Paglin, C., Research projects in residential technology, 15:2606 (R;US)
Pahl, D., *See* Tax, W., 15:3442
Paiva, J.R.T., *See* Menlove, H.O., 15:2168
Palchik, M.Ya., *See* Fradkin, E.S., 15:4038
Palmer, P.E., *See* Westrum, E.F. Jr., 15:3021
Palta, J.P., Impact of a simulated nuclear winter environment on growth development and productivity of potatoes, winter wheat, pines and soybeans, 15:3489 (R;US)
Palumbo, A., Contribution to atmospheric pollution of the activities of CSI Italsider in Bagnoli, 15:3415 (TG;US)
Panchal, C.B., *See* Rabas, T.J., 15:2330
Pandharipande, V.R., Variational theory of nuclear and neutron matter, 15:4124 (R;US)
Pankov, A.A., Polarization asymmetries of large P_t leptons at hadron colliders in E_6 theories, 15:3989 (R;XA)
Pant, H.C., *See* Bhattacharyya, B., 15:4315
Pantaleone, J., *See* Ma, E., 15:4010
Paolini, F.J., *See* Brown, I.G., 15:3301
Papaconstantopoulos, D.A, *See* Sanborn, B.A., 15:2885
Papademetriou, S., *See* Koch, K., 15:3153
Papadopoulos, G.M., Implementation indices (1975-1979). Volume 1. Technical report, 15:4497 (R;US)
Papadopoulos, K., *See* Lui, A.T.Y., 15:4367
Papamichael, K., Determination and application of bidirectional solar-optical properties of fenestration systems, 15:2335 (BA;US)
Parakhnevich, V.V., Program of accelerated plotting the isodose distribution in computer planning of gamma therapy of malignant tumors, 15:3671 (RA;SU;In Russian)
Pare, V.K., *See* Mihalczo, J.T., 15:3125
Parent, D.C., *See* Fearey, B.L., 15:3905
Parise, J.B., *See* Egami, T., 15:2905
Park, H.K., Energy confinement time and electron density profile shape in TFTR [Tokamak Fusion Test Reactor], 15:4350 (R;US)
Study of electron density and pressure profile behavior in a tokamak plasma, 15:4351 (R;US)
Park, J., Low-frequency self-pulsations in asymmetric external-cavity semiconductor lasers due to multiple-feedback effects, 15:3180 (J;US)
Park, J.-H., *See* Dominguez-Rodriguez, A., 15:2902
Park, Su-Moon, Electrochemical characterization and derivatization of coal: Final technical report, September 15, 1986–September 14, 1989, 15:2059 (R;US)
Parker, B.H., *See* Flom, Y., 15:2973
Parker, D.H., *See* Lau, A.M.F., 15:3175
Parker, H.M., Columbia River situation: A semi-technical review, 15:3548 (R;US)
Parker, L.C., *See* Joyce, J.P., 15:2650, 15:2651
Parker, P.D., *See* Wang, T.F., 15:4082
Parks, E.K., *See* Weiller, B.H., 15:3091
Parsons, D.K., Neutronics design of the INEL [Idaho National Engineering Laboratory] facility for boron neutron capture therapy clinical trials, 15:2490 (R;US)
Pastorok, R.A., Comparison of bioassays for assessing sediment toxicity in Puget Sound. (Appendices included). Report for 1988-1989 (Final), 15:3561 (R;US)
Pastukhov, V.P., *See* Kesner, J., 15:4482
Patankar, S.V., *See* Karki, K.C., 15:3196
Patel, A., *See* Moses, G.A., 15:4461
Patel, M.A., *See* Bloom, I., 15:2945
Patil, P.G., Electric vehicle battery R and D in the context of a propulsion system, 15:2584 (B;US)
See Henriksen, G.L., 15:2588
Patrick, R.E., *See* Shen, S.S., 15:4446
Patrinos, A.A.N., An acid rain study in the Washington, D.C. area, 15:3472 (J;US)
Patterson, A.G., *See* Dravid, N.V., 15:2416
Patton, H.G., *See* Christie, D.J., 15:4442
Paul, C.R., *See* Box, H.C., 15:3723
Paul, P., *See* Becker, K., 15:4136
Paul, S., *See* Brueckner, W., 15:3955
Pauli, H.C., *See* Eller, T., 15:3996
Paulikas, A.P., *See* Beno, M.A., 15:4249
Pautasso, G.R., Neutral beam injection current drive sensitivity study for the tokamak ignition/burn experimental reactor II, the U.S.: Option for International Thermonuclear Reactor, and the International Tokamak Reactor, 15:4483 (J;US)
Pavlov, A.S., Clinical experience of application of automated radiotherapy with the use of optimized computer programs, 15:3670 (RA;SU;In Russian)
Pavlovich, V.M., *See* Belenkov, V.V., 15:3633
Pawlack, I., *See* Huebel, K., 15:3567
Payne, H.S., *See* Mounce, J.M., 15:2711
Payne, M.G., *See* Chen, C.H., 15:3174
See Moore, M.A., 15:3176
Payne, S.A., Excited state absorption of Sm^{2+} in SrF_2, 15:3178 (J;US)
Payne, S.S., *See* Frese, M.H., 15:3308
Peak, J., *See* Abratt, V., 15:3598
Peak, M., *See* Abratt, V., 15:3598
Pearce, D.W., *See* Mickelson, M.L., 15:3504
Pearse, S.R., *See* Cernicek, M., 15:3593
Pearson, J., *See* Okamoto, P.R., 15:2861
Peason, C., *See* Carroll, A., 15:3269
Pechan, E.H., *See* McGowin, C.R., 15:2078
Pecho, W., *See* Weber, T., 15:4113
Pedersen, D.R., Safety aspects of the US advanced LMR [liquid metal reactor] design, 15:2501 (R;US)
Pedersen, K., *See* Elefsen, F., 15:2733

Pedersen, R.A., Analysis of cell lineage during early mouse embryogenesis: Mechanisms and risk, 15:3683 (BA;US)
Pedraza, A.J., *See* Godbole, M.J., 15:2878
Peek, J.M., One-dimensional model for photodetachment in a static electric field, 15:3912 (J;US)
Peercy, P.S., *See* Follstaedt, D.M., 15:2865
See Stiffler, S.R., 15:2998
See Tsao, J.Y., 15:3000
Peerenboom, J.P., *See* Whitfield, R.G., 15:4505
Peghaire, A., *See* Quebert, J., 15:4063
Peirano, W.B., *See* Bruins, R.J.F., 15:2775
Pelikan, P., *See* Bulian, N., 15:3342
Pellin, M.J., *See* Young, C.E., 15:4209
Pelte, D., Development of a 4π-detector system to be used at the SIS/ESR accelerator of the GSI/Darmstadt, 15:3339 (RA;DE;In German)
See Gnirs, M., 15:4096
Pelts, C.T., *See* Boenig, H.J., 15:4434
Pendzick, A., *See* Carroll, A., 15:3269
Penetrante, B.M., *See* Bardsley, J.N., 15:3914, 15:4384
Peng, Tsung-Hung, [The cause of the glacial to interglacial atmospheric CO_2 change]: Foreign trip report, October 14, 1989–October 24, 1989, 15:3424 (R;US)
Peng, Y-K. M., *See* Reid, R.L., 15:4395
Peng, Y.K.M., *See* Sayer, R.O., 15:4301
Penney, T.R., Desiccant cooling and dehumidification opportunities for buildings workshop, 15:2700 (R;US)
Pennycook, S.J., Precipitation, phase transformation, and enhanced diffusion in ion-implanted silicon, 15:2997 (BA;US)
Peraino, C., Comparison of the production and phenotypic properties of altered hepatocyte foci in rats initiated with diethylnitrosamine neonatally or after partial hepatectomy in early adulthood, 15:3599 (R;US)
Perepezko, J.H., *See* Follstaedt, D.M., 15:2865
Perera, R.C.C., Electronic bonding of buried interfaces determined by soft x-ray emission spectroscopy, 15:3019 (J;US)
Peres, J.M., *See* Van Kote, F., 15:2197
Pereyda, M., *See* Belton, M.J.S., 15:3867
Pereyra, P., *See* Harney, H.L., 15:4147
Perez, A., *See* McHargue, C.J., 15:2907, 15:2908, 15:2936
Perez, L., *See* Morsi, B.I., 15:2015
Perez, R., *See* Michalsky, J.J., 15:2699
Perez-Mendez, V., *See* Fujieda, I., 15:3354
Perino, M.A., *See* Landis, G.A., 15:2295
Perrigan, S., *See* Jacobson, J., 15:3404
Perry, M.D., *See* Christie, D.J., 15:4442
See Szoke, A., 15:3916
Persensky, J., *See* Coffman, F., 15:2537
Pesaran, A.A., Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems, 15:2340 (BA;US)
See Bingham, C.E., 15:2341
Pescar, *See* Benvenuti, A., 15:3357
Peskin, M.E., *See* Dixon, L.J., 15:4025
Peterkin, R.E. Jr., *See* Frese, M.H., 15:3308
Peterlinz, M.E., *See* Atallah, S., 15:2154
Peters, C., An alternate end design for SSC dipoles, 15:3300 (R;US)
Peters, R.W., The effects of heavy metals on the scaling ability of $CaCO_3$ and $Mg(OH)_2$, 15:3041 (R;US)
Petersen, E.L., Meteorology and Wind Energy Department annual progress report 1 January - 31 December 1988, 15:2361 (R;DK)
Peterson, D.E., *See* Kassner, M.E., 15:2869
Peterson, D.T., *See* Kai, K., 15:2955
Peterson, J.E., *See* Majer, E.L., 15:3812
Peterson, J.M., *See* Devgun, J.S., 15:2180
Peterson, R.R., *See* Moses, G.A., 15:4461
See Olson, R.E., 15:4477
Petkova, V.B., *See* Ganchev, A.Ch., 15:4270
Petradza, A., Study of four-lepton final states in electron-positron interactions at 29 GeV, 15:3963 (R;US)
Petrie, T.W., *See* Tabor, M.A., 15:4414
Petrosian, V., *See* Hamilton, R.J., 15:3850
Petrovick, M.L., *See* Benignus, V.A., 15:3755
Petukhov, V.N., Computerized tomography in diagnosis of dystrophic vertebrae lesions, 15:3628 (RA;SU;In Russian)
Petzold, R., Optically stimulated luminescence, 15:3061 (RA;DE;In German)
Peukert, W., Investigations on combined deposition of particulate and gaseous pollutants in a packed bed filter at high temperatures, 15:2730 (R;DE;In German)
Pfahler, R., *See* Duerr, W., 15:3263
Pfeilsticker, K., *See* Arnold, F., 15:3350
Pfirsch, D., *See* Morrison, P.J., 15:4309, 15:4385
Phillips, D.S., *See* Vogt, G.J., 15:2939
Phillips, G.W., *See* August, R.A., 15:3329
Phillips, J., *See* Hong, R., 15:4415
Phillips, M.H., *See* Frankel, K.A., 15:3677
See Rosander, K., 15:3745
Philipot, S.R., Elastic softening in nanocrystalline silicon, 15:2821 (R;US)
Phipps, R.D., *See* Solbrig, C.W., 15:2459
Phucharoen, W., *See* Chang, G.C., 15:2924
Pi, S., Inflation and non-equilibrium dynamics, 15:3876 (J;US)
Picciolo, J.J., *See* Dees, D.W., 15:2654, 15:2655
Picone, J.M., *See* Dahlburg, R.B., 15:3935
Picone, P.J., *See* Ohana, I., 15:2937
Picraux, S.T., *See* Haynes, T.E., 15:3001
Piemontese, L., *See* Benvenuti, A., 15:3357
Pienkos, P.T., *See* Dalton, H., 15:2268
Piepke, A., Measurement of γ angular distributions in ^{152}Dy and ^{152,153}Ho, 15:4104 (RA;DE;In German)
Pierce, E.L., *See* Hsieh, E.J., 15:2855
Pierce, P., *See* Arnold, W., 15:3321
Pierson, L.G., *See* George, M., 15:4534
Pietrafesa, L.J., *See* Vukovich, F.M., 15:2128
Pigeaud, A., Effects of coal-derived trace species on the performance of molten carbonate fuel cells: Topical report (Progress report No. 4), 15:2657 (R;US)
Pigford, T.H., *See* Hwang, Y., 15:2206, 15:2207, 15:2212
See Kim, C.-L., 15:2205
See Lee, W.W.-L., 15:2210
See Light, W.B., 15:2209
See Zwahlen, E.D., 15:2211
Pilparinen, M., *See* McNeill, J.H., 15:4101
Pilch, K., *See* Freedman, D.Z., 15:4048
Pillinger, C.T., *See* Wright, I. P., 15:3848
Pillsbury, R.D. Jr, Ring coil optimization with respect to stress, temperature, and system energy over a range of physics requirements, 15:4471 (BA;US)
Pillsbury, R.D. Jr., Design process for the CIT (compact ignition tokamak) poloidal field coil system, 15:4474 (BA;US)
Pilsner, B., Thermal barrier coating life prediction model, 15:2926 (RA;US)
Pilyavets, V.O., Assessment of time of programmed irradiation in the case of malignant tumors, 15:3672 (RA;SU;In Russian)
Pina, C.M., Study of Angra I reactor core with inserted control rods, 15:3991 (R;BR;In Portuguese)
Pinard-Legry, G., *See* Santarini, G., 15:2813
Pincosy, P.A., Design of a high-gain flux-compression generator, 15:4445 (R;US)
See Poulsen, P., 15:3140
Pindzola, M.S., *See* Muller, A., 15:3917
Piner, R., Computer control of the tunnel barrier width for the scanning tunneling microscope, 15:3374 (J;US)
Pines, A., *See* Samoson, A., 15:3375
Pinoli, A.A., *See* Sierra Alcazar, H.B., 15:2579
Pinter, S., Laboratory charging of dust by electrons and ions, 15:4229 (RA;DE;In German)
Pires, M.A.F., Determination of gadolinium in power and pellers of $(U,Gd)O_2$ by ion chromatography without supresion, 15:3050 (R;BR;In Portuguese)
Pirner, H.J., How does one see QCD degrees of freedom in physics of interacting hadrons?, 15:4000 (RA;DE;In German)
Nanti N-interaction, 15:4001 (RA;DE;In German)
Pisarski, R.D., Scattering amplitudes in hot gauge theories, 15:4052 (J;US)
Piszczor, M. Jr., *See* Flood, D.J., 15:2296

Pitale, L.A., *See* Kaup, D.J., 15:4361
Pitskhelauri, V.G., *See* Chernichenko, A.V., 15:3656
Pitts, J.H., Thermal stress in the edge cladding of Nova glass laser disks, 15:3172 (BA;US)
Pizzica, P.A., *See* Wang, C.Y., 15:2503
Planchon, H.P., LMR design to facilitate control, 15:2500 (R;US)
Platt, R.C., *See* Haworth, M.D., 15:3275
Plattner, G.R., *See* Baur, G., 15:4077
Plautz, W.A., *See* Westrum, E.F. Jr., 15:3021
Pletzer, R.K., Effect of shading devices on residential energy use in Austin, Texas. Research report, 15:2694 (R;US)
Pluemer, M., *See* Gyulassy, M., 15:4067
Pluhar, Z., An approximation for shell-model level densities, 15:4142 (RA;DE)
Plys, M.G., DOE modifications to the MAAP [Modular Accident Analysis Program] code: Volume 6, Core melt progression modeling and benchmarking WBS 3.4.8, 15:2515 (R;US)
Pobo, L.G., *See* Weiller, B.H., 15:3091
Poch, L.A., Regional application of natural-gas-fired combined-cycle power generation, 15:2759 (R;US)
Poelakker, K., Progress at LAMPF: Progress report, January–December 1988, 15:3946 (R;US)
Poepel, H.J., Rationalization of aerobic-thermophilic stabilisation by means of raw sludge dehydration, 15:2760 (R;DE;In German)
Poeppel, R.B., Practical superconductor development for electrical power applications: Annual report for FY 1988, 15:2432 (R;US)
See Nash, A.S., 15:2909
Poertner, R., Studies of the homogenization of structurally viscous and viscoelastic liquids in stirring containers, 15:2757 (TJ;US)
Pohlenz, D., *See* Korsch, W., 15:3322
Poker, D.B., Optical waveguide formation by ion implantation of Ti or Ag, 15:2940 (BA;US)
Pokorski, S., *See* Grzadkowski, B., 15:4024
Pole, M.W., *See* Walker, D.G., 15:2079
Politzer, P.A., Current drive at General Atomics, 15:4328 (RA;JP)
Pollack, J.B., Climate, atmosphere, and volatile inventory evolution: polar processes, climate records, volatile inventories, 15:3837 (RA;US)
Pollinger, J.P., Synthesis of oxide powders by plasma vaporization of solutions, 15:2938 (BA;US)
Pollock, E.L., *See* Blinder, S.M., 15:4294
Polyakov, P.Yu., *See* Chissov, V.I., 15:3657
Pompeu Junior, J., *See* Menten, J.O.M., 15:3686
Pomphery, D.N., *See* Pillsbury, R.D. Jr., 15:4474
Pomphrey, N., *See* Strickler, D.J., 15:4391
Pond, J., *See* Cukauskas, E., 15:3233
Ponder, W.H., Air toxics control situation room. Report for July 1988-March 1989, 15:3450 (R;US)
Pope, L.E., In situ ultrahigh vacuum friction measurement and wear track analysis of ion implanted 304 stainless steel, 15:2862 (BA;US)
Pope, W.L., Retractable gas cooled leads for ASTROMAG, 15:3130 (R;US)
Popie, J.A., *See* Curtiss, L.A., 15:2953, 15:3928, 15:3934
Porkolab, M., *See* Luckhardt, S.C., 15:4323
Porter, G.D., Neutral beam current drive scaling in DIII-D, 15:4331 (RA;JP)
See Rensink, M.E., 15:4450
Porter, L.C., Synthesis conductivity, and X-ray photoelectron spectrum of $Bi_2Sr_2Cu_{7+X}$. A new ternary bismuth-oxide system exhibiting metallic conductivity, 15:4252 (R;US)
Post, R.S., *See* Gaudreau, M.P.J., 15:4458
Posthill, J.B., *See* Solomon, G.S., 15:3013
Poston, J.W., *See* Fisher, D.R., 15:3748
Poteat, R.M., *See* Jenkins, M.G., 15:2913
Pott, G., *See* Ahlf, J., 15:2835
Poukey, J., *See* Bromborsky, A., 15:4182
Poukey, J.W., *See* Haworth, M.D., 15:3275
Poulheim, K.F., *See* Goergner, D., 15:4196
Poulsen, P., Inductive store opening switch and tests for energy transfer to a load, 15:3140 (R;US)
Povh, B., *See* Brueckner, W., 15:3955
Powell, D.C., Estimation of turbulence variance and scale, simplified for wind turbine applications, 15:2389 (BA;US)
Powell, R.H., *See* Larson, T.K., 15:4515
Powers, T.J., Quantitative evaluation of air-filtration systems in use at asbestos abatement sites: Research in progress, 15:3256 (R;US)
See Kominsky, J.R., 15:3437, 15:3438
Powter, C.B., *See* Walker, D.G., 15:2079
Prada, V.A., *See* Menten, J.O.M., 15:3686
Prapuolenis, A., *See* Peraino, C., 15:3599
Prater, R., *See* Hoffmann, E.H., 15:4407
Pregenzer, A.L., *See* Ruiz, C.L., 15:3311
Pregitzer, K.S., *See* Host, G.E., 15:2298
Preissler, B., *See* Arnold, F., 15:3350
Premo, W.R., *See* Tatsumoto, M., 15:3845
Premuzic, E.T., Interaction between thermophilic microorganisms and crude oils: Recent developments, 15:2107 (R;US)
Prepost, R., *See* Maruyama, T., 15:3015
Preston, D., *See* Warren, R.W., 15:3157
Prete, G., *See* Viesti, G., 15:4091
Preuss, W., Development of methods for the evaluation and reduction of risk factors for the maintenance of nuclear power plants, 15:2435 (R;DE;In German)
Price, C.W., Analyses of particles in beryllium by ion imaging, 15:2856 (R;US)
See Hsieh, E.J., 15:2855
Price, D.L., *See* Reijers, H.T.J., 15:2887
Price, K.R., *See* Eberhardt, L.E., 15:2232
Prieto, F.J., Sequential quadratic programming algorithms for optimization, 15:4545 (R;US)
Prigogine, I., The behavior of matter under nonequilibrium conditions: Fundamental aspects and applications: Progress report, April 15, 1989–April 14, 1990, 15:4262 (R;US)
Prodell, A., *See* Herrera, J., 15:3327
Proffitt, C.R., Nonlinear pulsations of luminous He stars, 15:3873 (BA;US)
Pruetz, W.A., Oxygen enhancement of free radical damage to DNA. A comparison of radiation-induced degradation with copper-catalyzed degradation by H_2O_2, 15:3701 (RA;DE)
Pryfogle, P.A., Biosorption of molybdenum and chromium, 15:3546 (R;US)
Przybyszewski, J., *See* Box, H.C., 15:3723
Przybyszewski, J.S., *See* Hulse, C.O., 15:3367
Puchinina, E.A., Local complications of radiotherapy in macrofractionated irradiation of patients with larynx cancer, 15:3664 (RA;SU;In Russian)
Puentes, E., *See* Sethi, V.K., 15:2093
Pugatch, V., *See* Reiner, K., 15:4085
Pugh, H.G., Search for the quark-gluon plasma (1989): The NA35 experiment at the CERN SPS, 15:4066 (R;US)
Pumphrey, P.H., *See* Akhurst, K.N., 15:2816
Pustovojtenko, V.T., *See* Sel'khov, Yu.I., 15:3631
Pyyskaenen, S., *See* Jauhiainen, J., 15:2682

Q

Qian, G., *See* Fernando, G.W., 15:4247
Qiu, S.L., The formation of metal-oxygen species at low temperatures, 15:4253 (R;US)
Qualls, A.L., *See* Gouge, M.J., 15:4388
Quanci, J., *See* File, J., 15:4465
Quebert, J., Search for characteristic times governing the emission of two particles from an excited nucleus, 15:4063 (R;FR)
Quenzel, H., Estimation of aerosol absorption from measurements of intensity and polarization of the sky radiation at Tsumeb (Namibia). Final report, 15:2291 (R;DE;In German)
Quesada, M.A., *See* Lau, A.M.F., 15:3175
Quigley, D.R., *See* Ward, B., 15:2063
See Yeh, G.J.C., 15:2062
Quigley, G.P., *See* York, G.W., 15:3171
Quon, B.H., Preferential electron-cyclotron heating of hot electrons and formation of overdense plasmas, 15:4378 (J;US)
Qureshi, S., *See* Fujieda, I., 15:3354
Qvist, B., *See* Ahlstroem, M., 15:2754

R

Raven, S., *See* Braaten, N.A., 15:2891

Rebas, T.J., Integration and optimization of the gas removal system for hybrid-cycle otec power plants, 15:2330 (BA;US)

Rebello, P.N.P., *See* Hunt, J.G., 15:4187

Rabin, B.M., *See* Hunt, W.A., 15:3756

Rabitz, H., *See* Yetter, R.A., 15:3087

Rabkin, I.Kh., Methods of improving the quality of examinations in radiodiagnosis, 15:3632 (RA;SU;In Russian)

Racine, W.C., *See* Merten, G.P., 15:2564, 15:2565

Raczka, P.A., Renormalization scheme dependence in the next-to-next-to-leading order and the high energy behaviour in QCD, 15:3990 (R;XA)

Raczka, R., *See* Raczka, P.A., 15:3990

Radke, C.J., *See* Ettinger, R.A., 15:2109, 15:2111

Rafelski, H.E., *See* Muller, B., 15:4177

Rafelski, J., *See* Muller, B., 15:4177

Raftery, A.E., Are ozone exceedance rates decreasing? Comment on extreme value analysis of environmental time-series: An application to trend detection in ground-level ozone. Technical report, 1 January-31 July 1989, 15:3401 (R;US)

Rahe, J., *See* Belton, M.J.S., 15:3867

Rahmani, A., Study of the energetic proton production in relativistic heavy ions Ne + nuclei collisions, using Diogene detector. Hadronic matter temperature, 15:4068 (R;FR;In French)

Rahn, L.A., Dephasing-induced coherences: higher-order selection rules and experiments in a magnetic field, 15:3901 (J;US)

Raicevic, J., *See* Fischer, F., 15:3481

Raina, P.K., *See* Sharma, S.K., 15:4129

Raistrick, I.D., *See* Cooke, D.W., 15:2921
See Roy, T., 15:2922

Rajagopalan, R.G., Finite difference analysis of the three dimensional flow field of a vertical axis wind turbine, 15:2391 (BA;US)

Rajainmaeki, Hannu., Hydrogen and helium in metals: positron lifetime experiments. Quarterly report 3. quarter 1987, 15:2839 (R;FI)

Rajan, J.B., *See* Saricks, C.L., 15:3407

Rajpoot, S., Electroweak interactions with gauged baryon and lepton numbers, 15:4061 (J;US)

Raju, M.R., *See* Carpenter, S., 15:3754

Rakestraw, D.J., Use of a charge-coupled device camera for broadband coherent anti-Stokes Raman scattering measurements, 15:3377 (J;US)

Rakhmanov, S.K., *See* Belenkov, V.V., 15:3633

Rakov, A.V., *See* Borejsho, D.E., 15:3634

Raleigh, J.A., Secondary reaction in irradiated nucleotides: Possible significance for chemical 'repair' mechanisms, 15:3725 (RA;DE)

Ramanathan, R., *See* Dallas, C.E., 15:3757

Ramey-Smith, A., *See* Coffman, F., 15:2537

Ramil, E., *See* Oldfield, E., 15:2957

Ramos-Izquierdo, L., Diode-pumped laser research, 15:3164 (RA;US)

Ramsey, A.T., *See* Park, H.K., 15:4350

Rancoita, P.G., *See* Bertrand, C., 15:3331

Rand, P.B., *See* Arnold, C. Jr., 15:3036

Randall, P.M., *See* Howell, S.G., 15:2742

Rankin, J., A cross-sectional TEM study of the effects of annealing conditions on the regrowth of lead-implanted single crystal calcium titanate, 15:2941 (BA;US)

Ransom, V.H., Course A—Numerical modeling of two-phase flows for presentation at Ecole d'Ete d'Analyse Numerique, 15:2516 (R;US)

Ransome, R.D., *See* Brueckner, W., 15:3955

Rao, A.S.P., Degassing history of Mars from Martian atmosphere samples, 15:3838 (RA;US)

Raptis, A.C., *See* Kupperman, D.S., 15:3213
See Sheen, S.H., 15:3366
See Sheen, Shuh-Haw, 15:2053

Rashid, R., *See* Sonntag, C. von, 15:3719

Rashid, Y.R., *See* Billone, M.C., 15:2504

Rasmussen, F., *See* Aagaard Madsen, H., 15:2372
See Voelund, P., 15:2382

Rasmussen, N.H., *See* Bolet, B., 15:2674

Rasmussen, R.A., Sources of methane in China: A program to estimate the emissions from rice paddies, biogas pits and urban areas: Annual progress report, 15:3411 (R;US)

Rath, J., *See* Erhorn, H., 15:2680

Rath, P.K., *See* Sharma, S.K., 15:4133

Rathbun, L.A., The determination of the penetrating radiation dose at Hanford, 15:4195 (R;US)

Ratner, E.Z., Assessment of battery technologies for electric vehicles: Volume 1, 15:2576 (R;US)
See Henriksen, G.L., 15:2588

Ratner, T.G., *See* Monzul', G.D., 15:3675

Ravindram, M., Environmental issues associated with coal-fired power plants in India, 15:2431 (J;US)

Rawson, S.A., *See* McElroy, D.L., 15:2186

Raymer, M.G., *See* Beck, M., 15:3183

Raymond, R.S., *See* Krisch, A.D., 15:3281

Rayner, S., *See* Wachs, A.L., 15:4258

Reass, W.A., A cost effective battery bank for I^2t testing and evaluation of electrical switchgear, 15:4432 (R;US)
Fiber optic control and diagnostic family of hardwares for the Confinement Physics Research Facility (CPRF) toroidal field and dc interrupter systems, 15:4433 (R;US)
Testing of a 50 kA, 50 kV current interrupter with I^2t preheating and long recovery voltage, 15:4436 (R;US)

Rech, M., *See* Gyufko, R., 15:4090, 15:4092, 15:4093
See Kruechten, B. v., 15:3338

Reda, D.C., Liquid-crystal, shear-stress-visualization experiments on a horizontal axis wind turbine, 15:2403 (BA;US)

Redey, L., Calorimetric measurements on electrochemical cells with Pd-D cathodes, 15:2575 (R;US)

Reed, J.W., *See* McCann, M.W. Jr., 15:2526

Reed, K.J., *See* Chen, M.H., 15:3907

Reed, L.D., *See* Millar, J.D., 15:3684

Reedy, R.C., Cosmogenic nuclides: Observable effects of Martian volatiles, 15:3839 (RA;US)

Reeme, T.L., Community relations programs: Improved planning through better understanding of communication systems, 15:2592 (R;US)

Reeves, G.A., *See* Cooke, D.W., 15:2921

Rehm, R.M., *See* Walata, S.A., 15:3452

Rehn, L.E., *See* Aziz, M.J., 15:2857
See Ding, F.R., 15:2859
See Koike, J., 15:2873
See Okamoto, P.R., 15:2861

Reich, H., The source for polarized alkali ions, 15:3290 (RA;DE;In German)
See Becker, K., 15:4097

Reichenbach, N.G., *See* Moss, R.D., 15:2413

Reid, R.L., Architecture of the ETR systems code, 15:4459 (BA;US)
Potential minimum cost of electricity of superconducting coil tokamak power reactors, 15:4395 (R;US)

Reifenberger, R., *See* Piner, R., 15:3374

Reijers, H.T.J., Structural properties of liquid alkali-metal–lead alloys: NaPb, KPb, RbPb, and CsPb, 15:2887 (J;US)

Reilly, M.S., *See* Arasteh, D.K., 15:2690

Reilly, S., Window 3.1: A computer tool for analyzing window thermal performance, 15:2342 (BA;US)

Reindl, J., Wisconsin waste reduction and recovery plan, 15:2745 (R;US)

Reiner, K., Emission of fast protons in (e,e'p) coincidence experiments, 15:4085 (RA;DE;In German)

Reinhart, R., *See* Paglin, C., 15:2606

Reinhold, C.O., *See* Meng, L., 15:3919

Reis, E., *See* Smith, J.P., 15:4410

Reisman, A., *See* Walters, M., 15:3328

Rej, D.J., Performance of the 10kV, 100-kA pulsed-power modules for the FRX-C magnetic compression experiment, 15:4428 (R;US)

Renema, F., *See* Robertson, D.W., 15:4520

Renken, R.L., *See* Gottlieb, S., 15:4060

Renlund, A.M., *See* Skocypec, R.D., 15:3381

Rensink, M.E., Practical aspects of a 2-D edge-plasma model, 15:4450 (R;US)

Renwick, W.H., *See* McLaughlin, F.B., 15:3551

Reny, D.A., Risk assessment and risk management for an experimental nuclear waste processing facility, 15:2193 (R;US)
Repnow, R., *See* Duerr, W., 15:3263
Reshotko, E., *See* Fernholz, H.H., 15:3185
Reuter, W.G., *See* Graham, S.M., 15:2833
Revcolevschi, A., *See* Wachs, A.L., 15:4258
Reven, L., *See* Oldfield, E., 15:2957
Revzan, K.L., *See* Fisk, W.J., 15:2691
See Nazaroff, W.W., 15:2688
Rey, S., *See* Ordonez, C.R., 15:4009
Reynolds, J.R., *See* Joyce, J.P., 15:2650, 15:2651
Rhen, I., Sunclay clay plant at Kungsbacka. Technical follow-up of the thermal storage, 15:2351 (R;SE;In Swedish)
Rhoades-Brown, M.J., Feynman–Monte Carlo calculations of electron capture at relativistic collider energies, 15:4176 (J;US)
Rhoads, R.E., *See* Haerer, H.A., 15:3749
See Napier, B.A., 15:3750
Rhodes, J.W., Behavioral measurement of laser flashblindness in rhesus monkeys. Final report, June-August 1985, 15:3796 (R;US)
Rhodes, W.J., *See* Harmon, D.L., 15:3441
Rhyne, J.J., *See* Fernandez-Baca, J.A., 15:2819
Ribbens, C.J., Parallel mathematical software: Technical progress report, September 16, 1988–February 14, 1990, 15:4513 (R;US)
The parallel performance of Schwarz splitting, 15:4508 (R;US)
Rible, M., *See* Robertson, D.W., 15:4520
Rice, J.P., *See* Rothman, S.J., 15:2914
Rich, R.E., *See* Messier, D.R., 15:2967
Richard, J.M., *See* Dover, C.B., 15:4070
See Pirner, H.J., 15:4001
Richards, D.R., *See* Zasadzinski, J.F., 15:4254
Richards, J.B., *See* Christie, D.J., 15:4442
Richards, P.M., Effect of density change on rapid liquid-solid interface kinetics and heat flow, 15:3208 (BA;US)
Molecular-dynamics investigation of deuteron separation in $PdD_{1.1}$, 15:2963 (J;US)
Richards, S.R., Two-step process for conversion of lignocellulose into methane, 15:2266 (R;DK)
Richardson, F., *See* Zey, J.N., 15:3458
Richardson, J.W. Jr., *See* Reijers, H.T.J., 15:2887
Richardson, R.A., *See* Burke, A.F., 15:2792
Richmond, C.R., *See* Anderson, T.D., 15:2610
Rickard, W.H., Strontium-90 in Canada goose eggshells: Non-fatal monitoring for contamination in wildlife, 15:3515 (R;US)
Riedel, K.S., Uncertainties associated with extrapolating L mode energy confinement to ITER and CIT, 15:4305 (R;US)
Ries, H., *See* Breskin, A., 15:3346
Riesz, P., *See* Kondo, T., 15:3718
Riley, D.J., *See* Bacon, L.D., 15:3227
Riley, S.J., *See* Weiller, B.H., 15:3091
Rill, R.L., The impact of energy related pollutants on chromosome structure: Progrss report, May 1, 1987–April 30, 1990, 15:3761 (R;US)
Rimke, H., *See* Achenbach, W., 15:4117
Risebrough, R.W., Accumulation patterns of heavy metals and chlorinated hydrocarbons by sea otters, Enhydra lutris, in California. Final report, 15:3788 (R;US)
Risin, S.A., Thymaline as a factor of homeostasis correction in the process of radiotherapy, 15:3652 (RA;SU;In Russian)
Risina, D.Ya., *See* Risin, S.A., 15:3652
See Shevko, V.A., 15:3665
Ritter, R.C., *See* Gillies, G.T., 15:3211
Ritz, C.P., *See* Lin, H., 15:4379
Rivarola, R.D., *See* Wang, Y.D., 15:3920
River, N., Compromise prior on the basis of maximum entropy, 15:4261 (R;US)
Rivier, N., Maximum entropy and equations of state for random cellular structures, 15:2969 (R;US)
Quasicrystals and grain boundaries, 15:2823 (R;US)
Rizzo, H.F., Formation of metastable structures and amorphous phases in Cu-W alloys using the triode sputtering technique, 15:2860 (BA;US)
Rizzo, T.G., *See* Barger, V., 15:4014
Ro, S.T., *See* Kim, J.H., 15:2805
Roberts, B.L., *See* Whitehouse, D.A., 15:3971
Roberts, B.W., Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)
Roberts, J.P., *See* Tallman, C.R., 15:3170
Roberts, P.V., In-situ aquifer restoration of chlorinated aliphatics by methanotrophic bacteria. Research report, 1 May 1985-30 April 1989, 15:3554 (R;US)
Roberts, T.C., *See* Czajkowski, C.J., 15:2457
Roberts, T.M., Red spruce decline—Winter injury and air pollutants, 15:3427 (R;US)
Robertson, A., *See* Findlay, W.O., 15:3485
Robertson, D.W., Scry: A distributed image handling system: Version 1.1, 15:4520 (R;US)
Robertson, I.M., *See* Bench, M.W., 15:2991
See Rozenak, P., 15:2870
Robertson, J.L., *See* Kan, X.B., 15:4241
Robertson, R.G.H., Neutrino mass: Recent results, 15:3959 (R;US)
Robinett, R.W., *See* Doncheski, M.A., 15:4015
Robinson, D.K., *See* Whitehouse, D.A., 15:3971
Robinson, D.L., A novel approach to a PPM-modulated frequency-doubled electro-optic cavity-dumped Nd:YAG laser, 15:3163 (RA;US)
Robinson, I.K., *See* Headrick, R.L., 15:3006
Robinson, P.A. Jr., The effects of high energy particles on planetary missions, 15:3362 (RA;US)
See Mewaldt, R.A., 15:3852
Robson, D., Research in theoretical physics: Technical progress report, 15:4033 (R;US)
Rocha, Z.N. da, *See* Naal, Z., 15:3053
Rodgers, B.R., Comparison of advanced power generation technologies using computer simulations, 15:2409 (R;US)
Rodrigue, P., *See* Burgoine, D., 15:2277
Roe, J.N., Optically based potassium sensor, 15:3372 (R;US)
Roedel, R., *See* Bulian, N., 15:3342
Rofer, C.K., *See* Finch, F.T., 15:2271
Rogers, H.W., *See* Driver, J.H., 15:3774
Rogers, J.D., *See* Boenig, H.J., 15:4434
Rogers, M. M., *See* Ho, C. M., 15:3204
Rogers, T., *See* Stein, W., 15:2399
Rogers, V.C., *See* Murphy, E.S., 15:2195
Rohatgi, U.S., *See* Van Tuyle, G.J., 15:2496
Rohlfing, E.A., Laser-induced-fluorescence spectroscopy of jet-cooled C_3, 15:3116 (J;US)
Rohwein, G., *See* Bromborsky, A., 15:4182
Romm, J.J., *See* Sastry, M.A., 15:2804
Ron, A., *See* Tzach, D., 15:4363
Rondorf, D.W., Assessment of smolt condition for travel time analysis: Annual report 1988, 15:2279 (R;US)
Roper, T.R., *See* Williams, L.E., 15:3445
Rosander, K., DNA damage in mammalian cells following heavy-ion irradiation, 15:3745 (R;US)
See Frankel, K.A., 15:3677
Rose, H.A., *See* Chen, H., 15:4296
Rosen, S., *See* Pedersen, D.R., 15:2501
Rosenbluth, M.N., *See* Montalvo, E., 15:4457
Rosenfeld, A., *See* Goldman, C.A., 15:2624
Rosenfeld, A.H., *See* Cairns, E.J., 15:2689
Rosengrant, L., *See* April, R., 15:2767
Rosenstein, M., Handbook of selected tissue doses for projections common in diagnostic radiology, 15:3679 (R;US)
Rosenthal, M.W., *See* Anderson, T.D., 15:2610
Roser, T., *See* Krisch, A.D., 15:3281
Rosocha, L.A., Kilojoule operation of the Aurora KrF ICF laser system at Los Alamos, 15:4453 (BA;US)
Ross, P.N. Jr, Zinc electrode and rechargeable zinc-air battery, 15:2589 (P;US)
Rossi, E., Wind tunnel tests of airfoil sections extended to high angles of attack, 15:2371 (RA;DK)
Rossman, L.A., Hybrid knowledge-based/algorithmic approach to the design of waste-treatment systems, 15:3234 (R;US)
Rossmassler, R.L., *See* Longhurst, G.R., 15:4406
Rossowsky, R., Physics and materials science of high-temperature superconductors. Final report, 15:3121 (R;US)
Rost, E., Dirac random-phase-approximation analysis of the inelastic scattering of 500 MeV protons from ^{40}Ca, 15:4170 (J;US)

Rostoker, N., *See* Tzach, D., 15:4363
Rotella, F.J., *See* Jorgensen, J.D., 15:3358
Roth, J.R., Space applications of fusion energy, 15:2493 (J;US)
Rothblum, U.G., *See* Eaves, B.C., 15:4548
Rothman, S.J., Anisotropy of oxygen tracer diffusion in $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:2914 (R;US)
Routbort, J.L., *See* Dominguez-Rodriguez, A., 15:2902
See Rothman, S.J., 15:2914
Rover, D.T., *See* Basore, P.A., 15:2311
Rovere, M., *See* Badirkhan, Z., 15:4217
Roy Chowdhury, A., *See* Sen, S., 15:4314
Roy, T., Microstructures of Y123 films on $SrTiO_3$, $LaGaO_3$ and $LaAlO_3$, 15:2922 (R;US)
Roylance, D.K., *See* Fullerton, R., 15:3226
Rozen, J.R., *See* Khachaturyan, K.A., 15:3010
Rozenak, P., Hydrogen effects in aluminum, 15:2870 (J;IL)
Rozhkovskaya, V.V., Use of color interpretation of roentgrams of chest organs, 15:3629 (RA;SU;In Russian)
Rubin, M., Ion implantation of sputtered Y-Ba-Cu-O films, 15:2951 (J;US)
Rubin, M.A., *See* Ordonez, C.R., 15:4009
Rubin, M.D., *See* Arasteh, D.K., 15:2690
Ruby, D.S., Safety considerations for high-efficiency crystalline-silicon solar cell fabrication, 15:2316 (BA;US)
Ruckelshausen, A., *See* Breitbach, G., 15:4105
Ruderman, H., *See* Wood, D.J., 15:2685, 15:2686, 15:2687
Rudman, D.A., *See* Lichtenwalner, D.J., 15:2898
Ruff, A.W., *See* Whitenton, E.P., 15:3216
Ruffin, J.E., Back to basics, 15:2753 (R;US)
Ruiz, C.L., Lithium beam measurements on PBFA II, 15:3311 (BA;US)
Ruland, R.E., *See* Fischer, G.E., 15:3310
Runchal, A.K., *See* Karki, K.C., 15:3196
Rupp, G., Bench-scale fixation of soils from the Tacoma Tar Pits Superfund Site. Final report, 15:3521 (R;US)
Rupprecht, A., *See* Zell, I., 15:3734
Ruscic, B., Molecular structure and thermal stability of B_2H_4 and $B_2H^+_4$ species, 15:2952 (J;US)
Structure and bonding in the B_2H_5 radical and cation, 15:3927 (J;US)
Rusek, K., *See* Becker, K., 15:4136
Rushton, B.L., *See* Parsons, D.K., 15:2490
Rusnak, B., *See* Cooke, D.W., 15:2921, 15:3128
Russ, J., *See* Bertrand, C., 15:3331
Russell, J.E., *See* Kronenberg, A.K., 15:2358
Russell, J.J., *See* Peraino, C., 15:3599
Russell, S., *See* Mcvey, J.B., 15:3198
Russo, P.A., *See* Hsue, S.-T., 15:2246
Ruusunen, J., Dynamic cooperative electricity exchange in a power pool. Research report, 15:2640 (R;FI)
Ruzic, D.N., *See* Caughman, J.B.O. II, 15:4392
Ryabov, O.L., *See* Naumenko, A.Z., 15:3635
Ryan, G., *See* Carroll, A., 15:3269
Ryan, P.M., *See* Caughman, J.B.O. II, 15:4392
Ryan, T., *See* Coffman, F., 15:2537
Rychel, D., *See* Gyufko, R., 15:4090, 15:4092, 15:4093
See Kruechten, B. v., 15:3338

S

Sabo, C., *See* Goldman, C.A., 15:2624
Saboungi, M., *See* Reijers, H.T.J., 15:2887
Sackett, J.I., Inherent controllability in modular ALMRs, 15:2507 (R;US)
See Planchon, H.P., 15:2500
Sacks, M.D., Dispersion and rheology in ceramic processing, 15:2942 (BA;US)
Sadrozinski, H.F., *See* Gunion, J.F., 15:4059
Sagara, Kenshi, *See* Koori, Norihiko, 15:4427
Sagstuen, E., Free radicals formation in nucleosides and nucleotides of guanine: ESR and ENDOR of guanosine 5'-monophosphate and guanosine: Di-methylformamide X-irradiated at 10 K, 15:3717 (RA;DE)
See Close, D.M., 15:3708
See Hole, E.O., 15:3712
See Nelson, W.H., 15:3716
Saint-Laurent, F., *See* Quebert, J., 15:4063
Saito, Tamotsu, *See* Matsuo, Hideto, 15:2491
Saito, Toshio, Gamma-ray irradiation effects of poly(ethylene-2, 6-naphthalate) and poly(ethylene-terephthalate), 15:2972 (R;JP;In Japanese)
Sakai, H., *See* Suda, T., 15:4074
Sakane, K.K., Spectroscopic analysis of orthonitrodiphenyl sulfide $C_{12}H_9NO_2S$, 15:4223 (R;BR;In Portuguese)
Sakata, Fumihiko, Breaking of separability condition for dynamical collective subspace. Onset of quantum chaos in large-amplitude collective motion, 15:4152 (R;JP)
See Matsuo, Masayuki, 15:4155
Sakitt, M., *See* Whitehouse, D.A., 15:3971
Sako, Kiyoshi, *See* Hiraoka, Toru, 15:2462
Sakuma, Eiichiro., *See* Itoh, Hisayoshi, 15:2920
Sakuragi, Yukinori, *See* Koori, Norihiko, 15:4427
Sakurai, M., Development of Fusion and Plasma Diagnostics Center - synchrotron radiation experiment, (2). Characterization of primary monochromator and construction of calibration apparatus and its application, 15:4318 (R;JP;In Japanese)
Salama, T.M., *See* Abd El-Sattar, A. Dabbour, 15:4279
Salamin, Y.I., *See* Barut, A.O., 15:3888
Sales, B.C., *See* Sonder, E., 15:2959
Salesky, E.T., *See* York, G.W., 15:3171
Sallinen, V., *See* Leino, O., 15:2684
Salomon, M., *See* Whitehouse, D.A., 15:3971
Salonen, Pentti, Recent decommissioning experiments - a literature survey. Quarterly report 3. quarter 1987, 15:2436 (R;FI;In Finnish)
Salopek, D.S., Designing density fluctuation spectra in inflation, 15:3878 (J;US)
Salpas, P.A., Volcanic rocks and the geologic history of Mars, 15:3840 (RA;US)
Saltsman, J.F., *See* Halford, G.R., 15:2846
Salzborn, E., *See* Muller, A., 15:3917
Samoson, A., Double rotor for solid-state NMR, 15:3375 (J;US)
Sampson, D.H., *See* Zhang, Hong Lin, 15:3896, 15:3897
Sanborn, B.A., Empirical electron-phonon coupling constants and anisotropic electrical resistivity in hcp metals, 15:2885 (J;US)
Sanchez, F.H., *See* Tan, Z., 15:3028
Sanchez, H., *See* Piepke, A., 15:4104
Sandberg, J., *See* Carroll, A., 15:3269
Sander, L.M., *See* Li, G., 15:2880
Sandhu, S.S., Application of a simple short-term bioassay for the identification of genotoxins from hazardous wastes, 15:3782 (R;US)
See Gill, B.S., 15:3776
Sandoval, W.F., *See* Greiner, N.R., 15:3155
Sands, A., *See* Faber, P.M., 15:3538
Sanford, N.M., *See* Burnham, A.K., 15:4355
Sankaran, A.V., U, Th and K distributions inferred from regional geology and the terrestrial radiation profiles in India, 15:3505 (R;IN)
Sano, Fumimichi and othe, *See* Kondo, Katsumi, 15:4345
Santamaria, G., *See* Hong, R., 15:4415
Santana Carvalho, J.L. d, *See* Almeida, M.C.M. de, 15:2167
Santana Lamartin Montes,, *See* Lima, M.I.C. de, 15:3044
Santangelo, J., *See* Abratt, V., 15:3598
Santarini, G., Stress corrosion cracking of nickel base alloys characterization and prediction, 15:2813 (R;FR)
Santini, D.J., The slowdown of 1989–90: Further evidence for the use of transportation sector indicators to predict GNP growth, 15:2591 (R;US)
Santos Scardino, A.M. do, Decay of ^{57}Ni, 15:4084 (R;BR;In Portuguese)
Saphir, B., *See* Crawford, J.D., 15:4310
Sargent, E.N., Technique for chest radiography for pneumoconiosis, 15:3678 (R;US)
Saricks, C.L., Environmental quality and the shift to alternative fuels: Progress and interim findings of a Department of Energy study of transition in vehicular power systems, 15:3407 (R;US)
Sarkar, S., *See* Bhattacharyya, B., 15:4315
Sarkar, S.K., *See* Hershberger, J.F., 15:3933

Sarmiento, J.L., [The role of oceans in determining atmospheric CO_2]: Foreign trip report, October 14, 1989–October 22, 1989, 15:3425 (R;US)
Sartory, W.K., *See* Gillies, G.T., 15:3211
Sasajima, Hideo, Study on the behavior of waterside corroded PWR fuel rods under reactivity initiated accident conditions, 15:2535 (R;JP;In Japanese)
Sasaki, N., *See* Arai, T., 15:3804
See Miyahara, K., 15:2224
Sasaki, Noriaki, *See* Idemitsu, Kazuya, 15:2223
Sastry, M.A., Can the U.S. economy survive a few nuclear weapons, 15:2804 (J;US)
Sastry, S.S., Binding of adenosine diphosphoribosyltransferase to the termini and internal regions of linear DNAs (deoxyribonucleic acids), 15:3597 (R;US)
Satchler, G.R., *See* Fricke, S.H., 15:4166
Sato, M. and others, *See* Morimoto, S., 15:4347
Sato, Mitsuru, *See* Hiraoka, Toru, 15:2462
Sato, Seiji, *See* Watanabe, Takao, 15:2656
Sato, T., Development of mechanical-pilot injection device for automotive diesel engines, 15:2786 (R;JP)
See Matsuda, Y., 15:4320
Satsunkevich, I.S., *See* Pankov, A.A., 15:3989
Sauer, W., Thermoluminescence dating of sediments, 15:3060 (RA;DE;In German)
Sauvage, D., *See* Breskin, A., 15:3346
Savkova, N.V., Dependence of local radiation complications on methods of intracavitary gamma-therapy in concomitant radiotherapy of stage 1 cervix uteri carcinoma, 15:3741 (RA;SU;In Russian)
Savrasova, N.A., Advanced methods of instantaneous zonography of temporal bone pyramids, 15:3630 (RA;SU;In Russian)
Sawan, M.E., *See* ElGuebaly, L.A., 15:4467
See Olson, R.E., 15:4477
See Yasar, O., 15:2557
Sayer, R.O., ITER disruption modeling using TSC [Tokamak Simulation Code], 15:4301 (R;US)
Scalapino, D.J., *See* Schlesinger, Z., 15:2958
Schaefer, G., *See* Kissel, J., 15:3348, 15:3349
Schaffer, M., *See* Smith, J.P., 15:4410
Schaich, C.R., *See* Schwenterly, S.W., 15:4390
Schatz, K.W., *See* Holve, D.J., 15:3469
Schechter, D.E., *See* Gouge, M.J., 15:4388
Scheiffele, G.W., *See* Sacks, M.D., 15:2942
Scherrer, A., *See* Achenbach, W., 15:4117
Scheurer, J.N., *See* Stolterfoht, N., 15:4071
Schiemenz, P., *See* Korsch, W., 15:3322
Schiffer, J.P., Crystalline beams, 15:3316 (R;US)
Schiffgens, J.O., PLOTnFIT: A BASIC program for data plotting and curve fitting, 15:4522 (R;US)
Schilcher, K., *See* Doncheski, M.A., 15:4015
Schillaci, M.E., *See* Carpenter, S., 15:3754
Schipper, L., *See* Hawk, D.V., 15:2631
See Wilson, D., 15:2622
Schirmer, J., Detection of the γ branch for the shape isomer in ^{236}U, 15:4118 (RA;DE;In German)
See Engelke, V., 15:4094
Schissel, P., *See* Smith, D.M., 15:2344
Schivell,, *See* Park, H.K., 15:4350
Schlachter, A.S., *See* Bernstein, E.M., 15:3926
Schlesinger, M.E., Seasonal climatic changes induced by doubled CO_2 as simulated by the OSU atmospheric GCM/mixed-layer ocean model, 15:3471 (J;US)
Schlesinger, Z., Superconducting energy gap and a normal-state excitation in $Ba_{0.6}K_{0.4}BiO_3$, 15:2958 (J;US)
Schlueter, R., *See* Shay, H.D., 15:3167
Schluter, L.L., *See* Sutherland, H.J., 15:2398
Schlyer, D.J., Cyclotron targetry for production of short-lived positron emitters, 15:3102 (R;US)
Schmalzer, D.K., Biocrude suitability for petroleum refineries, 15:2269 (R;US)
Schmidt, H., *See* Duerr, W., 15:3263
Schmitt, C., *See* Khan, S., 15:4072
Schmitt, F.J., *See* Ahlf, J., 15:2465, 15:2835
Schmitt, M.J., Theory of harmonic radiation using a single-electron source model, 15:3160 (R;US)
Schmitt-Strecker, S., *See* Chalkias, S., 15:3493
Schmitz, H.A., Nucleation and propagation of cracks at grain boundaries in zinc bicrystals, 15:2875 (J;US)
Schmitz, L., *See* Kuthi, A., 15:4382
Schmoltner, A.-M., Molecular beam studies of oxygen atom reactions with unsaturated hydrocarbons, 15:3109 (R;US)
Schneekloth, U., *See* Benvenuti, A., 15:3357
Schneemeyer, L.F., *See* Dessau, D.S., 15:2956
Schneider, D., *See* Stolterfoht, N., 15:4071
Schneider, K., *See* Wunderlich, R., 15:3295
Schneider, T., *See* Gandy, R.F., 15:4399
Schnitzler, B.G., *See* Akers, D.W., 15:2485
Schobert, H.H., Inhibition of retrogressive reactions in coal/petroleum co-processing: Quarterly technical progress report, June 1, 1989–August 31, 1989, 15:2025 (R;US)
See Davis, A., 15:2026
Schoch, K., The Hood River Story: How a conservation project was implemented: Volume 1, Final report, 15:2670 (R;US)
Schoen, A., *See* Breskin, A., 15:3346
Schoenberg, K.F., *See* Thullen, P., 15:4360
Schoenfeld, R., Corrosion database for the nuclear fuel cycle. Subproject no. 1. Final report, 15:4544 (R;DE;In German)
Schofield, P., *See* Morris, F.W., 15:2978
Schonberg, E., *See* Wegner, P., 15:4526
Schrank, L.S., *See* Reass, W.A., 15:4433
Schreck, R., *See* Bellm, D., 15:4086
Schrock, S.L., *See* Kring, C.T., 15:2170
Schroder, W.U., *See* Toke, J., 15:4168
See Wile, J.L., 15:4100
Schroeder, S., *See* Baumann, W., 15:3294
Schuch, R., *See* Arnold, W., 15:3321
See Baumann, W., 15:3345, 15:3890
Schuchman, J.C., Vacuum system design for a superconducting x-ray lithography light source, 15:3314 (R;US)
Schuchmann, H.P., *See* Sonntag, C. von, 15:3719
Schuehrer, B., *See* Baumann, H., 15:2254, 15:3291, 15:3292
Schuermann, B., *See* Gyufko, R., 15:4090, 15:4092, 15:4093
See Kruechten, B. v., 15:3338
Schuessler, H., Protein-DNA-crosslinks induced by primary and secondary radicals, 15:3729 (RA;DE)
Schuhardt, S.L., A county-level approach to regional resource analysis based on climate simulation, 15:3396 (J;US)
Schuller, I.K., *See* Beno, M.A., 15:4249
See Zhang, K., 15:4250
Schulte-Frohlinde, D., The effect of oxygen and thiols on the radiation damage of DNA, 15:3715 (RA;DE)
See Bothe, E., 15:3728
See Hildenbrand, K., 15:3730
See Tossi, A.B., 15:3733
Schultz, D.R., Comparison of single-electron removal processes in collisions of electrons, positrons, protons, and antiprotons with hydrogen and helium, 15:3910 (J;US)
Schultz, F.J., Nondestructive assay and nondestructive examination of remote-handled transuranic waste at the ORNL waste handling and packaging plant, 15:2181 (R;US)
Schultz, P.H., Role of impact cratering for Mars sample return, 15:3841 (RA;US)
Schulz, E., *See* Klatt, C., 15:3341
Schulz, H.J., *See* Khan, S., 15:4072, 15:4075, 15:4076, 15:4089, 15:4135
Schulz, T., *See* Wefers, H., 15:3803
Schulze, H.J., Jet production and decay in relativistic pp collisions, 15:3995 (RA;DE)
Schumacher, S., *See* Pinter, S., 15:4229
Schuster, D.P., Positron emission tomography of the lung, 15:3681 (BA;US)
Schuster, M.H., *See* Czajkowski, C.J., 15:2457
Schuurman, J.J., *See* Bakema, G.F., 15:2333
Schwalm, D., *See* Baumann, W., 15:3293, 15:3294, 15:3345, 15:3889, 15:3890
See Breitbach, G., 15:4105
See Engelke, V., 15:4094

See Gerl, J., 15:4115
See Hennrich, H.J., 15:4095
See Klatt, C., 15:3341
See Korten, W., 15:4114
See Kramp, J., 15:3344
See Lubkiewicz, E., 15:4103
See Schirmer, J., 15:4118
See Schwartz, B., 15:4116
See Thirolf, P., 15:4102
Schwan, A., *See* Kruechten, B. v., 15:3338
Schwartz, B., Spectroscopic investigations of the neutron-deficient nuclei ^{220}Th and ^{222}Th, 15:4116 (RA;DE;In German)
Schwartz, M.N., *See* Skyllingstad, E.D., 15:2230
Schwarz, M., *See* Ruscic, B., 15:2952, 15:3927
Schwegler, J., *See* Cooke, D.W., 15:4256
Schweitzer, M., The practice of utility least-cost planning: A report on a study-in-progress, 15:2633 (R;US)
Schweizer, K.S., Integral equation theory of the structure and thermodynamics of polymer blends, 15:3022 (J;US)
Schwenterly, S.W., Location and repair of air leaks in the ATF [Advanced Toroidal Facility] vacuum vessel, 15:4390 (R;US)
Sciacca, F., Radiation-related impacts for nuclear plant physical modifications: Final report, 15:2543 (R;US)
Scott, A.G., *See* Findlay, W.O., 15:3485
Scott, S.D., *See* Park, H.K., 15:4350
Scott, S.P., Waste-water characterization survey, Little Rock AFB, Arizona. Final report, 11-24 July 1988, 15:3577 (R;US)
Scovel, C., Symplectic numerical integration of Hamiltonian systems, 15:4286 (R;US)
Scriven, L.E., *See* Chapela, G.A., 15:3089
Scrosati, B., Lithium-polymer-electrolyte battery: Electrochemical behavior of cathode materials. Technical report, July 1988-June 1989, 15:2567 (R;US)
Scrudder, R.O., *See* Moss, R.D., 15:2413
Seabourn, C.M., *See* Joyce, J.P., 15:2650, 15:2651
Seader, J.D., *See* Massoth, F.E., 15:2021
Seager, C.H., *See* Anderson, R.A., 15:2852
Seay, W.M., *See* Devgun, J.S., 15:2180
Sebo, D.E., Reactor Safety Assessment System, 15:2482 (BA;US)
Sedman, C.B., *See* Drehmel, D.C., 15:3249
See Jozewicz, W., 15:3444
Seeger, M., *See* Khan, S., 15:4076, 15:4135
Seelinger, W., *See* Sulzer, G., 15:4228
Seely, J.F., *See* Brown, C.M., 15:3925
Segel, R.E., Fragmentation of high-spin particle-hole states in ^{26}Mg, 15:4081 (R;US)
Segev, A., Event-join optimization in temporal relational databases, 15:4543 (R;US)
See Kumar, A., 15:4541
Segre, C.U., *See* Zhang, K., 15:4250
Seguchi, Tadao, *See* Saito, Toshio, 15:2972
Seibert, U., *See* Bellm, D., 15:4086
Seiden, A., *See* Gunion, J.F., 15:4059
Seiler, W., Wide-range fuel flowmeter. Phase 2. Final report, 4 June 1986-3 February 1988, 15:2121 (R;US)
Seilkop, S.K., *See* Clark, T.L., 15:3460
Sekhar, P.C., *See* Venkateswarlu, P., 15:2097
Seki, M., *See* Inoue, T., 15:4439
Seki, Yasushi, *See* Tachikawa, Katsuhiro, 15:4424
Sekula, S.T., [Fabrication of superconducting films]: Foreign trip report, September 23, 1989–October 11, 1989, 15:2931 (R;US)
Sel'khov, Yu.I., Computerized tomography of spinal cord in contrasting, 15:3631 (RA;SU;In Russian)
Self, S.A., *See* Sze, J.S., 15:3898
Seligman, P., *See* Montopoli, M., 15:3457
Selivanov, K.G., *See* Kogan, Ya.I., 15:3987
Selkowitz, S., *See* Papamichael, K., 15:2335
Selvaggi, B., *See* Scrosati, B., 15:2567
Semenyuk, N.I., *See* Miroshnichenko, V.F., 15:3799
Semler, M.O., Radiological survey of the Mare Island Naval Shipyard, Alameda Naval Air Station, and Hunters Point Shipyard, 15:3568 (R;US)
Semmens, M., *See* Magdich, P., 15:2132
Semprini, L., *See* Roberts, P.V., 15:3554
Sen, S., On the quantum inverse problem for a new type of nonlinear Schroedinger equation for Alfven waves in plasma, 15:4314 (R;XA)
Sengers, J.V., *See* Krall, A.H., 15:3210
Senior, R., An interior vessel viewing system for DIII-D, 15:4408 (R;US)
Senseny, P.E., *See* Munson, D.E., 15:2233
Seo, D., *See* Park, J., 15:3180
Serbeto, A., *See* Levush, B., 15:3169
Sercel, J., *See* Orth, C.D., 15:4475
Serfass, J., Hydrogen conference: Workshop proceedings, 15:2258 (R;US)
Sergeeva, I.I., *See* Rozhkovskaya, V.V., 15:3629
Sergeeva, N.S., *See* Chissov, V.I., 15:3657
Serig, D., *See* Coffman, F., 15:2537
Sernelius, B.E., Free-carrier absorption from Fibonacci sequences of δ-doped layers in silicon, 15:3025 (J;US)
Sessions, J.C., *See* Burkhalter, H.E., 15:4487
Sessler, A.M., A study of phase control in the FEL [free electron laser] two-beam accelerator, 15:3272 (R;US)
See Chen, P., 15:3277
Sethi, A., *See* Hintz, N.M., 15:4064
Sethi, V.K., Metal wastage analysis of carbon steel tubes in FBC environment, 15:2093 (R;US)
Sevilla, M.D., ESR investigations of the reactions of radiation-produced thiyl and peroxyl radicals: Formation of sulfoxyl radicals, 15:3714 (RA;DE)
Sevy, R.H., *See* Sackett, J.I., 15:2507
Sextro, R.G., *See* Fisk, W.J., 15:2691
See Nazaroff, W.W., 15:2688
Seymour, D., The Hazardous Materials Information Exchange: An electronic bulletin board for the emergency response community, 15:3494 (R;US)
Sezgin, E., *See* Bergshoeff, E., 15:4266
Shaarbaf, M., *See* Lei, J.F., 15:3368
Shabbar, A., *See* Klein, W.H., 15:3398
Shack, W.J., *See* Chopra, O.K., 15:2442
Shackelford, M.E., Attempted use of zinc in vivo to protect against nitrogen mustard toxicity in tumor-free and in L1210 leukemia-bearing $B6D2F_1$ mice, 15:3764 (R;US)
Shadwick, B., *See* Crawford, J.D., 15:4310
Shaffer, R.J., *See* Heuze, F.E., 15:2148
Shah, H.A., *See* Bulanov, S.V., 15:4313
Shah, J.N., *See* Atallah, S., 15:2154
Shalkovskij, I.I., Basis for use of combined treatment of patients with corpus uteri carcinoma including preoperative irradiation, 15:3658 (RA;SU;In Russian)
Shamir, M., *See* Baumann, H., 15:2254, 15:3291, 15:3292
Shamroth, S.J., *See* Buggeln, R.C., 15:3200
Shan, W., Pressure dependence of the *DX* center in $Ga_{1-x}Al_xAs$:Te, 15:3033 (J;US)
Shapir, Y., *See* Meirovitch, H., 15:3016
Shapiro, A.M., *See* Artemova, N.A., 15:3743
Shapiro, M., Electrostatic precipitation of charged particles from a turbulent flow between coaxial cylinders, 15:3402 (R;US)
Shapiro, R., *See* Broyde, S., 15:3760
Shapiro, S.M., *See* Noda, Y., 15:2884
Sharafat, S., Structure and insulator material choices for the TITAN reversed-field-pinch reactor study, 15:4470 (BA;US)
See Cooke, P.I.H., 15:4469
See Hasan, M.Z., 15:4468
Shariff, K., *See* Stanaway, S., 15:3205
Sharkey, A., *See* Morsi, B.I., 15:2015
Sharma, S., *See* Mortazavi, P., 15:3284
Sharma, S.K., Double beta decay matrix elements in the Germanium region, 15:4133 (R;XA)
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)
Sharon, A., Modeling of thermal hydraulic behavior and fission product releases in degraded cores, 15:2517 (R;US)
See Suh, K.Y., 15:2438
Shaw, N.M., Search for unstable heavy neutral leptons in e^+e^- annihilations at $\sqrt{s}$ from 50 to 60.8 GeV, 15:3970 (J;US)

Shay, H.D., Prospects for a soft x-ray FEL powered by a relativistic-klystron high-gradient accelerator (RK-HGA), 15:3167 (R;US)
Shea, C.E., *See* Linkous, C.A., 15:3071
Shea, M.A., Intensity/time profiles of solar particle events at one astronomical unit, 15:3855 (RA;US)
Toward a descriptive model of solar particles in the heliosphere, 15:3851 (RA;US)
Shea, W.T., *See* Kronenberg, A.K., 15:2358
Shechter, H., Anomalous local hopping of Sn impurities in lead, 15:2881 (J;US)
Sheehy, J.W., Detailed control technology survey of a coke-oven plant, 15:2050 (R;US)
Sheen, S.H., Cavitation-controlled ultrasonic agitator, 15:3366 (R;US)
Sheen, Shuh-Haw, Advanced research in instrumentation and control technology, 15:2053 (R;US)
Sheffield, R.L., *See* Goldstein, J.C., 15:3158
Sheffler, K.D., *See* Demasi, J.T., 15:2927
Sheh, M.Y., *See* Stouffer, D.C., 15:2842
Shen, L.K., Response characteristics of MHOST (MARC Hot-Section Technology) for 3-D inelastic analysis of hot-section components, 15:3239 (RA;US)
Shen, S.S., Design and fabrication of the CPQ [Conductor Performance Qualification] coil, 15:4446 (R;US)
Measurements of electromagnetic properties of LCT coils in IF-SMTF, 15:4478 (BA;US)
Shen, Y.R., *See* Superfine, R., 15:4234
Shen, Z., Photoemission study of monoclinic $BaBiO_3$, 15:2960 (J;US)
See Dessau, D.S., 15:2956
Shenoy, A.V., *See* Sacks, M.D., 15:2942
Shenoy, G.K., *See* Moncton, D.E., 15:3318
Shepard, J.R., *See* Rost, E., 15:4170
Shepherd, I.G., A tomographic study of premixed turbulent stagnation point flames, 15:3108 (R;US)
Sherby, O.D., *See* Sherman, D.H., 15:2827
Sherman, D.H., Steel initiative: Development of superplastic steel processing: First annual progress report, March 15, 1988–March 15, 1989, 15:2827 (R;US)
Sherman, R., *See* Sze, D.K., 15:4393
Sherwood, C.R., Current and suspended sediment measurements on the central California continental shelf, 15:3819 (R;US)
Sherwood, D.J., *See* Johnson, K.I., 15:2227
Sheu, R.S., *See* Sacks, M.D., 15:2942
Shevko, V.A., Immunologic status of patients with epidermoid lung cancer in radiotherapy on split course and chemoimmunotherapy, 15:3665 (RA;SU;In Russian)
Shi Jihuai., Bergman spaces, the Bloch space and the pluriharmonic conjugates in the unit ball of C^n, 15:4264 (R;XA)
D^p spaces on bounded symmetric domains of C^n, 15:4265 (R;XA)
Shi, D., Lattice defects and flux pinning in crystallized metal-oxide glasses in the Bi-Sr-Ca-Cu-O system, 15:2947 (J;US)
See Bloom, I., 15:2945
See Rothman, S.J., 15:2914
Shiau, F.Y., Amorphous phase formation by solid-state reaction between polycrystalline Co thin films and single-crystal GaAs, 15:3014 (J;US)
Shibahara, S., *See* Bottcher, J.H., 15:2463
Shibata, T.A., *See* Brueckner, W., 15:3955
Shiho, Makoto, *See* Kishimoto, Yasuaki, 15:4341
Shilling, R.C., *See* Green, M.A., 15:3299
Shimizu, Masatsugu, *See* Hiratsuka, Hajime, 15:4423
Shimomura, Hiroaki, Study on shaft vibration of gas circulators with gas-bearings for HENDEL helium test facility, 15:2454 (R;JP;In Japanese)
Shinkawa, T., *See* Cooper, M.D., 15:3950
Shinn, J.H., Beryllium dispersion near explosive firing tables: A comparison of computed and observed results, 15:3468 (R;US)
Shintomi, T., Design of a large superconducting spectrometer magnet, 15:3296 (R;JP)
Shiota, K., *See* Osaka, T., 15:2570
Shiraishi, Hiroshi, Operational characteristics of a metal vapor vacuum arc ion source, 15:3891 (R;US)
Shiraishi, K., Degenerate fermion and Wilson loop in 1+1 dimensions, 15:4021 (R;JP)
See Nakamura, A., 15:3827
Shockey, D.A., *See* Giovanola, J.H., 15:2806
Shore, J., *See* Oldfield, E., 15:2957
Short, R.W., *See* Skupsky, S., 15:3184
Shoshani, A., *See* Markowitz, V.M., 15:4542
Showalter, R.R., *See* Loree, T.R., 15:3179
Shrader, T.G., *See* Larson, T.K., 15:4515
Shrestha, G., Simple application of probability model for the mean age at marriage, 15:4277 (R;XA)
Shriner, D., *See* Jacobson, J., 15:3404
Shrope, A., *See* Horie, Y., 15:3558
Shum, S.L., *See* Merten, G.P., 15:2564, 15:2565
Shust, V.F., *See* Korytova, L.I., 15:3645
Sick, I., *See* Baur, G., 15:4077
Sickman, J.O., Characterization of year-round sensitivity of California's Montane Lakes to acidic deposition. Final report, October 1986-June 1989, 15:3552 (R;US)
Siddons, D.P., *See* Williams, G.P., 15:3283
Sidorchenkov, V.O., Intracavitary radiotherapy of malignant tumors of rectum, 15:3653 (RA;SU;In Russian)
Sieber, K., Matrix-isolation of free radicals from purines and derivatives in aqueous low temperature glasses, 15:3713 (RA;DE)
Siegel, M.R., *See* Geffen, C.A., 15:2243
Siegel, R.W., Nanophase materials assembled from atomic clusters, 15:2824 (R;US)
See Melendres, C.A., 15:2946
Siegman, A.E., Laser physics and laser techniques. Final report, 15:3154 (R;US)
Sierra Alcazar, H.B., The secondary slurry-zinc/air battery: Final report, 15:2579 (R;US)
Sigmund, P., *See* Belkacem, A., 15:4205
Sila Estrada, J.J. da an, *See* Knoefel, M.J., 15:2248
Silva Junior, O., *See* Lima, M.I.C. de, 15:3044
Silva Queiroz, C.A. da, Determination of HF in UF_4 contaminated by UO_2F_2, 15:2161 (R;BR;In Portuguese)
Some aspects of analytic control used in separation process of rare earths, 15:3049 (R;BR;In Portuguese)
Silva, E.L., Study of α-monosubstituted methyl acetates by C-13 and H-1 Nuclear Magnetic resonance, 15:4221 (R;BR;In Portuguese)
Silva, G.H., *See* Lima, M.I.C. de, 15:3044
Silva, G.R. da, Scoria analysis by X-ray fluorescence with briquet, 15:4224 (R;BR;In Portuguese)
Silva, S.P. da., *See* Araujo, R.M.S. de, 15:3054
Silva, T.V. da., Analytical use of zide ion. Chemical equilibrium studies and correlates in U(VI)/N_3 and Co(III)/N_3 systems, 15:3047 (R;BR;In Portuguese)
Silva, W., *See* Wong, I., 15:3807
Silveira, C.L.P. da., Geochemical of the sodic-uranium metasomatic mineralization from Espinhas (PB)-Brazil, 15:2160 (R;BR;In Portuguese)
Silverman, S., *See* Feynman, J., 15:3854
Simbirtseva, L.P., Radiotherapy in combined treatment of patients with breast cancer of early stages, 15:3654 (RA;SU;In Russian)
Simic, M.G., *See* Bergtold, D.S., 15:3724
Simion, G., *See* Sciacca, F., 15:2543
Simmons, D.W., *See* Gouge, M.J., 15:4388
Simon, R.S., *See* Lubkiewicz, E., 15:4103
See Schwartz, B., 15:4116
Simons, J.W., *See* Giovanola, J.H., 15:2806
Simpson, D.B., *See* Greene, S.R., 15:2528
Sims, W., *See* Carroll, A., 15:3269
Sinclair, C.K., *See* Maruyama, T., 15:3015
Sinclair, D.K., Finite temperature QCD with four light quark flavours, 15:4005 (J;NL)
See Kogut, J.B., 15:4006
Singer, R.M., *See* Planchon, H.P., 15:2500
Singh, J.P., *See* Kupperman, D.S., 15:3213
Singh, M.K., *See* Saricks, C.L., 15:3407
Singh, M.S., *See* Tobin, M.T., 15:4449
Singh, R.K., Pulsed laser mixing of metal overlayers on ceramics, 15:2943 (BA;US)
Siros, E., *See* Rozenak, P., 15:2870
Sishtla, C., The effect of system parameters on fines generation in limestone/coal char mixtures, 15:2048 (B;US)
Sivertz, M.B., *See* Auerbach, L.B., 15:3951

Skeldon, M., *See* Kessler, T.J., 15:4370
Skiad, P.S., *See* McHargue, C.J., 15:2907, 15:2908, 15:2936
Sklizkov, G.V, The theory of target compression by longwave laser emission, 15:4359 (B;US)
Skiyar, N.T., *See* Musaelyan, R.M., 15:4098
Skocypec, R.D., Fast transit gas- and condensed-phase chemistry of energetic materials, 15:3381 (R;US)
Skorkin, V.M., *See* Musaelyan, R.M., 15:4098
Skotheim, T.A., *See* Hale, P.D., 15:3600
See Yang, X.Q., 15:3035
Skrumsager, B., *See* Petersen, E.L., 15:2361
Skupsky, S., Improved laser-beam uniformity using the angular dispersion of frequency-modulated light, 15:3184 (J;US)
See Kessler, T.J., 15:4370
See Marshall, F.J., 15:4484
Skyllingstad, E.D., The identification of terrain-induced circulations using principal components, 15:2230 (R;US)
Slack, D.S., *See* Shen, S.S., 15:4446
Slaski, M., *See* Zhang, K., 15:4250
Slatick, E., *See* Harmon, J.R., 15:2280
Sleight, A.W., *See* Cox, D.E., 15:3031
See Egami, T., 15:2905
Slepetz, J.M., *See* Tsangarakis, N., 15:2966
Slingerland, R.L., *See* Alexander, S.S., 15:3814
Slough, C.G., Scanning tunneling microscopy of orthorhombic TaS_3, 15:2893 (J;US)
Slovik, G.C., *See* Van Tuyle, G.J., 15:2546
Smaga, J.A., Sodium/sulfur post-test analysis at ANL, 15:2573 (R;US)
Smart, D.F., Predicting the arrival times of solar particles, 15:3858 (RA;US)
See Shea, M.A., 15:3851
Smart, J.P., *See* Ten Brink, H.M., 15:2100
Smedskjaer, L.C., Fermi surfaces by positron annihilation in $YBa_2Cu_3O_x$, 15:4255 (R;US)
Smetanin, G.A., *See* Musaelyan, R.M., 15:4098
Smith, A.E., *See* Fullerton, R., 15:3226
Smith, A.R., *See* Fisk, W.J., 15:2691
Smith, A.W., *See* Basore, P.A., 15:2311
Smith, D.I., Gas velocity measurements in purged port posting systems, 15:3124 (R;GB)
Smith, D.L., *See* James, R.B., 15:3177
See Meadows, J.W., 15:4111
Smith, D.L.,, *See* Haworth, M.D., 15:3275
Smith, D.M., Metal substrates and the photodegradation of polymers. Pt. 2. An FTIR study of polyethylene terephthalate and polyvinyl fluoride, 15:2344 (J;NL)
Smith, E.O., FGD damper guidelines: Volume 2, Guidelines: Final report, 15:2071 (R;US)
FGD [flue gas desulfurization] damper guidelines: Volume 1, Fundamentals and survey results: Final report, 15:2070 (R;US)
Smith, G., *See* Carroll, A., 15:3269
Smith, G.P., *See* Crosley, D.R., 15:2153
See John, R.W., 15:2662
Smith, G.R., *See* Ho, S.K., 15:4381
See Matsuda, Y., 15:4327
Smith, J.E., *See* Batstone, R., 15:2750
Smith, J.J., International bulletin on atomic and molecular data for fusion. No. 39, 15:4317 (R;XA)
Smith, J.M., *See* Mickelson, M.L., 15:3504
Smith, J.P., Design of DIII-D Advanced Divertor, 15:4410 (R;US)
Smith, J.R., SBS [stimulated Brillouin scattering] pulse distortion in multimode optical fibers: Preliminary results, 15:4451 (R;US)
Smith, J.T., Rapid inversion of multi-dimensional magnetotelluric data, 15:3805 (R;US)
Smith, K.A., *See* Johnson, L.K., 15:3918
Smith, L., *See* Combs, J., 15:3580
Smith, L.R., *See* Ingalls, M.N., 15:2796
Smith, M., *See* Crawford, N.M., 15:3607
Smith, M.S., *See* Wang, T.F., 15:4082
Smith, N.D., *See* Bare, J.C., 15:3436
Smith, N.V., Distance of the image plane from metal surfaces, 15:2890 (J;US)
Smith, R., *See* Wong, I., 15:3807
Smith, R.D., Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:3371 (R;US)
Smith, R.L., *See* Cernicek, M., 15:3593
Smith, T.L., *See* Burley, B.L., 15:4413
Smits, A.J., *See* Fernholz, H.H., 15:3185
Smoliar, S., *See* Wegner, P., 15:4526
Smoot, G.F., *See* Gavin, L.M., 15:3131
Smuin, M.W., *See* Crutcher, J.W., 15:3511, 15:3512, 15:3513, 15:3514
Smyrl, W.H., *See* Naoi, K., 15:2568, 15:2571
Sneddon, L.G., Synthesis and properties of new preceramic materials: Research progress report, December 1, 1988–November 30, 1989, 15:2970 (R;US)
Snel, H., Two simple models for dynamic inflow, 15:2369 (RA;DK)
Snelgrove, J.L., *See* Bretscher, M.M., 15:2489
Snider, M.A., *See* Schmalzer, D.K., 15:2269
Snyder, S.L., *See* Kalinich, J.F., 15:3690
Snyder, T.R., Characterization and modification of particulate properties to enhance filtration performance: Quarterly technical progress report, December 1988–February 1989, 15:2423 (R;US)
Snyder, W.H., Integration of fluid modeling with complex-terrain field studies and model-development efforts, 15:3449 (R;US)
Soares, S.M.V.O., Oil wells and gas wells: aspects of radiological safety, 15:2123 (R;BR;In Portuguese)
Sobrinho, J.T., *See* Menten, J.O.M., 15:3686
Socolow, R.H., *See* Dudney, C.S., 15:2693
Soderholm, L., *See* Beno, M.A., 15:4249
Soerensen, H., *See* Halsnaes, K., 15:2626
Sohal, M.S., Field testing of a ceramic heat exchanger for heat recovery application, 15:2727 (R;US)
Sohns, C.W., *See* Gouge, M.J., 15:4388
Sokolov, B.V., *See* Naumenko, A.Z., 15:3635
Sokolov, Y.A., The status of work on the ITER project in the USSR, 15:4402 (TG;US)
Solbrig, C.W., Thermal hydraulic analysis of fuel reprocessing Argon Cell accidents in the demonstration integral fast reactor, 15:2459 (R;US)
See Forrester, R.J., 15:2502
Solnyshkin, A.A., *See* Cathat, C.L., 15:4158
Solomon, G.S., Antiphase domain boundary formation in single-crystal chalcopyrite-structure $ZnGeAs_2$ grown on GaAs, 15:3013 (J;US)
Soman, S.D., *See* Nambi, K.S.V., 15:4190
Sonder, E., Effects of oxygen and strontium vacancies on the superconductivity of single crystals of $Bi_2Sr_{2-x}CuO_{6-y}$, 15:2959 (J;US)
Sonntag, C. von, The $SO^{-}{}_{\cdot 4}$-induced oxidation of 1,3,6-trimethyluracil and 1,3-dimethylthymine by potassium peroxodisulphate and oxygen in aqueous solution: An interesting contrast, 15:3719 (RA;DE)
See Deeble, D.J., 15:3727
See Mieden, O.J., 15:3732
Soper, D.E., *See* Ellis, S.D., 15:4011
Sorensen, J.H., [Emergency planning for technological and natural hazards]: Foreign trip report, October 1, 1989–October 15, 1989, 15:2594 (R;US)
Sotirchos, S.V., Pore structure and reactivity changes in hot coal gas desulfurization sorbents: Technical progress report, July–September 1989, 15:2067 (R;US)
Soukoulis, C.M., *See* Economou, E.N., 15:2962
Soule, D.E., Spectral model for instantaneous advanced window performance, 15:2338 (BA;US)
Soures, J.M., *See* Skupsky, S., 15:3184
Souza, R. de., Falling-sphere radioactive viscometry, 15:3190 (R;BR;In Portuguese)
Spahn, M., *See* Khan, S., 15:4072, 15:4075, 15:4076, 15:4089, 15:4135
Spain, S., *See* Mori, S., 15:3379
Sparks, D.O., *See* Gouge, M.J., 15:4388
Sparks, W.M., *See* Starrfield, S., 15:3875
Speer, J., *See* Gyufko, R., 15:4090, 15:4092, 15:4093
See Kruechten, B. v., 15:3338
Spencer, B.W., *See* Wang, C.Y., 15:2503
Spendler, F.H., *See* Richards, S.R., 15:2266

Speyer, D.M., *See* Ginsberg, A.P., 15:2558
Spicer, W.E., *See* Dessau, D.S., 15:2956
See Shen, Z., 15:2960
Spong, D.A., Alpha modification of Tokamak ballooning instabilities, 15:4304 (R;US)
Spooner, S., *See* Rozenak, P., 15:2870
Sprangle, P., *See* Hafizi, B., 15:4456
Spring, E.F., *See* DiMeglio, A.F., 15:2488
Springborg, M., Electrons and phonons in polymeric sulfur nitride, 15:3034 (J;US)
Springer, E., *See* Dagan, G., 15:2202
Springer, E.P., *See* Nguyen, V., 15:2201
Sprinkle, J.K. Jr., *See* Hsue, S.-T., 15:2246
Spulak, R.G. Jr., Detection of Alpher-Rubin attenuation and a search for nuclear acoustic resonance of surface waves in tantalum films, 15:2886 (J;US)
Squire, J., *See* Luckhardt, S.C., 15:4323
Squyres, S.W., *See* Lo, I.Y., 15:3355
Srivastava, L., Use of ash in highway construction: Delaware demonstration project: Final report, 15:2069 (R;US)
Stacey, W.M. Jr., *See* Pautasso, G.R., 15:4483
Stack, H.F., *See* Waters, M.D., 15:3766, 15:3775
STack, H.F., *See* Waters, M.D., 15:3768
Staffeldt, E.F., *See* Peraino, C., 15:3599
Staffin, R., *See* Hrubesh, L.W., 15:2987
Stallman, R.M., *See* Reny, D.A., 15:2193
Stallmann, F.W., *See* Kam, F.B.K., 15:2510
Stampfer, M.R., *See* Leadon, S.A., 15:3794
Stanaway, S., Head-on collision of viscous vortex rings, 15:3205 (RA;US)
Stara, J.F., Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)
See Bruins, R.J.F., 15:2775
Stark, C., *See* Wong, I., 15:3807
Starke, T.P., *See* Cooke, D.W., 15:3128
Starnes, G.L., *See* Miller, P.B., 15:2415
Starrfield, S., Hydrodynamic studies of oxygen, neon, and magnesium novae, 15:3875 (BA;US)
Staudt, A., *See* Bender, E., 15:4139
Stearns, J.W., *See* Bernstein, E.M., 15:3926
Stearns, S.D., Detection of a chirping electromagnetic signal, 15:4288 (R;US)
Stebbings, R.F., *See* Johnson, L.K., 15:3918
Stechel, E.B., Exchange-driven pairing of delocalized carriers in high-temperature superconductors, 15:4260 (J;US)
Steele, S.M., *See* Bauer, W.F., 15:3609
Steele, T.R., A search for single electron production in electron positron annihilation at E = 29 GeV, 15:3964 (R;US)
Steele, W.F., *See* Kwan, J.W., 15:3305
Steenken, S., Pulse radiolysis studies on one-electron oxidation of purines, 15:3720 (RA;DE)
Steenlage, R., *See* Van der Wal, J.F., 15:2704
Stefan, H.G., Formulation of water-quality models for streams, lakes, and reservoirs: Modeler's perspective. Final report, 15:3544 (R;US)
Steffens, E., *See* Korsch, W., 15:3322
Steffens, W., Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report, 15:3506 (R;DE;In German)
Stein, D., Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Brown rockfish, copper rockfish, and black rockfish, 15:3537 (R;US)
Stein, W., Development of the University of Massachusetts wind/diesel simulator, 15:2399 (BA;US)
Stein, W.A., Mixing times during the stirring of gas-charged viscous liquids (Part 3), 15:2756 (TJ;US)
Stein, W.E., *See* Warren, R.W., 15:3156
Steinacker, R., *See* Huebel, K., 15:3567
Steingrimsson, B., *See* Aunzo, Z., 15:2355, 15:2356
Stella, P.M., *See* Flood, D.J., 15:2296
Stelte, N., *See* Storck, R., 15:2198
Stenberg, R., *See* Franca, L.P., 15:3192, 15:3193
Stephan, D.G., EPA's (Environmental Protection Agency's) approach to pollution prevention, 15:2595 (R;US)
Stephenson, G.G., Guidelines for the prevention of economizer inlet header cracking in fossil boilers: Final report, 15:2412 (R;US)
Stephenson, W.A., *See* Klimas, P.C., 15:2407
Stepp, A.K., *See* Chase, K.L., 15:2114
Stern, C.H., *See* Bohn, M.S., 15:2324
Stern, E.A., *See* Ma, Y., 15:2894
See Shechter, H., 15:2881
Sterrett, R.H., *See* Merten, G.P., 15:2564, 15:2565
Stevens, A.A., Formation and control of non-trihalomethane by-products, 15:3556 (R;US)
Stevens, F.J., *See* Peraino, C., 15:3599
Stevens, H.C., *See* Rabas, T.J., 15:2330
Stevens, P.A., The bonding of acetonitrile and CH_2CN on Ag(110) determined by near edge x-ray absorption fine structure: Evidence for π-donor bonding and azimuthal ordering, 15:3090 (J;US)
Stevens, R.L., The interesting future of supercomputing, 15:4509 (R;US)
Stevenson, P.M., *See* Duck, I.M., 15:4293
Stewart, D.S., *See* Jackson, T.L., 15:3106
Stewart, J.A., *See* Krisch, A.D., 15:3281
Steyaert, J.J., *See* Khan, S., 15:4076
Stiffler, S.R., Supercooling of silicon and germanium after laser melting, 15:2998 (BA;US)
Still, G.W., *See* Bromborsky, A., 15:4182
Stillman, G.E., *See* Holonyak, N., 15:3145
Stillman, P., *See* Carroll, A., 15:3269
Stine, W.B., *See* Hogan, R.E., 15:2326
Stiop, L.D. and others, *See* Pavlov, A.S., 15:3670
Stirling, D.I., *See* Dalton, H., 15:2268
Stoeckmann, H.J., *See* Sulzer, G., 15:4228
Stoft, S., *See* Kahn, E.P., 15:2635
Stohr, J., *See* Stevens, P.A., 15:3090
Stoker, C.R., Experimental simulations of oxidizing conditions and organic decomposition on the surface of Mars, 15:3842 (RA;US)
Stokes, R.W., *See* Mounce, J.M., 15:2711
Stoloff, N.S., Exploratory study of niobium, titanium, zirconium, and tantalum aluminides. Final report, 1 March 1988-31 May 1989, 15:2807 (R;US)
Stolte, G., Technical and economic factors influencing the exploration of black-coal deposits in developing countries, 15:2081 (RA;DE;In German)
Stolterfoht, N., Experimental and theoretical study of two center electron emission in 25-MeV/u Mo^{40+} + He collisions, 15:4071 (R;FR)
Stone, E.C., *See* Cummings, A.C., 15:3862
Storck, R., Disposal in salt formations, 15:2198 (R;FR)
Stouffer, D.C., Anisotropic constitutive modeling for nickel base single crystal superalloy Rene N4 at 982 C, 15:2842 (RA;US)
Stover, R., A raster scanning power supply system for controlling relativistic heavy ion beams at the Bevalac biomedical facility, 15:3280 (BA;US)
Strain, R.V., *See* Bottcher, J.H., 15:2463
Strakh, A.G., Research in photon irradiation dose fields forming by wedgeshaped filters, 15:3673 (RA;SU;In Russian)
Strandburg, K.J., Random-tiling quasicrystal, 15:4244 (J;US)
Strangman, T.E., Thermal barrier coating life-prediction model development, 15:2925 (RA;US)
Strayer, D.M., *See* Wang, R.T., 15:3161
Strayer, M.R., *See* Rhoades-Brown, M.J., 15:4176
Street, R.A., *See* Fujieda, I., 15:3354
See Khachaturyan, K., 15:3029
Streeter, R., *See* Morsi, B.I., 15:2015
Streets, D.G., The development of clean coal technology in the United States, 15:2013 (R;US)
US Energy use: New technologies and policies in response to global warming, 15:3408 (R;US)
Streit, G.E., *See* Finch, F.T., 15:2271
Strickler, D.J., Equilibrium shape control in CIT [Compact Ignition Tokamak] PF [poloidal field] design, 15:4391 (R;US)
Stritzker, B., *See* Aziz, M.J., 15:2857
Stroeher, H., *See* Breitbach, G., 15:4105
Strongin, M., *See* Qiu, S.L., 15:4253

Strottman, D., *See* Oset, E., 15:4160
Stroud, C.R., *See* Koch, K., 15:3153
Strum, M.J., *See* Sherman, D.H., 15:2827
Stubbemann, U., *See* Krankowsky, D., 15:3821
Stygar, W.A., *See* Ruiz, C.L., 15:3311
Su, Shiaw-Der, *See* Boshoven, J.K., 15:2194
Subbarao, V., *See* Venkateswarlu, P., 15:2097
Subramanian, M.A., *See* Cox, D.E., 15:3031
See Egami, T., 15:2905
Suda, T., Measurement of the analyzing power of p(n,γ)d reaction, 15:4074 (RA;JP)
Sudarshan, E.C.G., *See* Duck, I.M., 15:4293
Suek, P., *See* May, B., 15:2278
Sugar, R.L., *See* Gottlieb, S., 15:4060
Sugiura, M., Solar diurnal variation in the amplitude of sudden commencements of magnetic storms at the geomagnetic equator, 15:3885 (R;US)
Suh, K.Y., In-core thermal hydraulic and fission product calculations for severe fuel damage analyses, 15:2438 (R;US)
Sults, B.H., Nuclear magnetic resonance imaging as a tool to characterize defect densities in solids, 15:4201 (R;US)
Sullivan, E.A., *See* Williams, G.P., 15:3283
Sullivan, J.A., *See* Harris, D.B., 15:4437
Sullivan, J.P., *See* Nikjooy, M., 15:3197
Sultanian, B.K., *See* Hylton, L.D., 15:3202
Sulzer, G., Nuclear spin relaxation of ^{12}B implanted in various metallic single crystals, 15:4228 (RA;DE;In German)
Summerfield, G.C., Dislocation-hydrogen correlation in metals, 15:4203 (R;US)
Summers, J.R., Development of a centralized solvent recovery system at Carswell Air Force Base, 15:3801 (R;US)
Summers, L.T., Cryogenic magnet case and distributed structural materials for high-field superconducting magnets, 15:4473 (BA;US)
See Kerns, J.A., 15:4472
See Shen, S.S., 15:4446
Sunaga, Hiromi and other, *See* Mitsui, Hiroshi, 15:2294
Sundaram, Meenakshi, *See* Nambi, K.S.V., 15:4183
Sundaram, V.K., *See* Nambi, K.S.V., 15:4190
Sundaram, V.S., *See* Fraas, L.M., 15:2319
Sunta, C.M., *See* Nambi, K.S.V., 15:4190
See Sankaran, A.V., 15:3505
Sunwoo, A.J., Effects of precipitate distribution on 293 K and 77 K properties of 2090-T81 weldments, 15:2840 (R;US)
Superfine, R., Conformation, orientation and interaction in molecular monolayers: A surface second harmonic and sum frequency generation study, 15:4234 (R;US)
Surkova, I.V., *See* Musaelyan, R.M., 15:4098
Survanshi, S.S., *See* Weathersby, P.K., 15:3614
Susman, S., *See* O'Hare, P.A.G., 15:2968
Sutela, T., *See* Huusko, A., 15:2289
Sutherland, H.J., Crack propagation analysis of WECS components using the LIFE2 computer code, 15:2398 (BA;US)
See VanDenAvyle, J.A., 15:2396
Sutton, E.C., *See* Danchi, W.C., 15:3118, 15:3119
Svestka, J., *See* Pinter, S., 15:4229
Sviatoslavsky, I.N., *See* ElGuebaly, L.A., 15:4467
Swain, J.E., *See* Christie, D.J., 15:4442
Swain, R.L., *See* Nanstad, R.K., 15:3215
Swaminathan, V.P., Gas turbine blade life assessment and repair guide: Final report, 15:2414 (R;US)
Swanson, D.G., Cyclotron emission asymmetry from Kirchhoff's law in a mode-conversion layer, 15:4373 (J;US)
See Gandy, R.F., 15:4399
Swanson, G.A., *See* Meyer, T.G., 15:2845
Swanson, M.S., *See* Haller, K., 15:3942
Swartzendruber, L.J., *See* Bennett, L.H., 15:2812
Swartzlander, A.B., *See* Berry, W.B., 15:2310
Swec, D.M., Ion beam and plasma methods of producing diamond-like carbon films, 15:2929 (R;US)
Sweeney, M.C., *See* Cullis, P.M., 15:3711
Swenson, D.A., *See* Lennox, A.J., 15:3619
Swietlik, C.E., *See* Whitfield, R.G., 15:4505
Swift, D.C., *See* Christie, D.J., 15:4442
Swift, D.L., Regional aerosol deposition in human upper airways: Annual progress report, March 1, 1989–February 28, 1990, 15:3414 (R;US)
Swindle, T.D., Noble gases as tracers of the origin and evolution of the Martian atmosphere and the degassing history of the planet, 15:3843 (RA;US)
Sylwester, A.P, *See* Arnold, C. Jr., 15:3036
Symons, M.C.R., *See* Cullis, P.M., 15:3711
Symons, M.J., *See* Adams, F.D., 15:4185
Symons, P.C., *See* Ratner, E.Z., 15:2576
Szalewicz, K., Fusion rates for hydrogen isotopic molecules of relevance for "cold fusion", 15:4175 (J;US)
Sze, D.K., The Breeding Blanket Interface (BBI) and the Tritium Systems Test Assembly (TSTA), 15:4393 (R;US)
Sze, J.S., Investigation of an electron beam evaporative source: Part 1, Theory; Part 2, Measurements, 15:3898 (R;US)
Szerman, M., *See* Erhorn, H., 15:2680
Szoke, A., Experimental study of atomic structure in strong electromagnetic fields, 15:3916 (J;US)
Szostak, R., *See* Csencsits, R., 15:2989
Szwarc, K., *See* Van Tuyle, G.J., 15:2496

T

Tabor, M.A., Mechanical design of an infrared imaging system for DIII-D, 15:4414 (R;US)
Tachikawa, Katsuhiro, Quick installation/removal technology for first wall, 15:4424 (R;JP;In Japanese)
Tackett, J.R., *See* Whitaker, R.B., 15:3380
Tadrist, L., Jet instabilities in liquid-liquid systems. Application to direct contact heat exchangers, 15:3188 (R;FR;In French)
Taft, S.O., *See* Burnham, A.K., 15:4355
Taguchi, Masayoshi, ECRH current drive in the presence of high energy electrons, 15:4329 (RA;JP)
Taluti, M., *See* Viesti, G., 15:4091
Takahisa, K., *See* Suda, T., 15:4074
Takano, H., *See* Arai, T., 15:3804
Takano, Hideki, *See* Hiraoka, Toru, 15:2462
See Takizuka, Takakazu, 15:2471
Takano, Yasumasa, *See* Ihas, G.G., 15:3938
Takeda, K., *See* Hirano, T., 15:2695
Takeda, Tatsuoki, Fracto-fusion. Mechanism of cold fusion, 15:4156 (R;JP)
Takeiri, Y. and others, *See* Motojima, O., 15:4441
Takemoto, B.K., *See* Bytnerowicz, A., 15:3446
Takeuchi, N., Theoretical study of noble-metal (100) surface reconstructions using first-principles techniques, 15:2877 (J;US)
Takizuka, T., *See* Itoh, K., 15:4332
See Kishimoto, Y., 15:4334
Takizuka, Takakazu, Thermal-hydraulics of actinide burner reactors. Conceptual study of actinide burner reactors, (3), 15:2471 (R;JP;In Japanese)
Takizuka, Tomonori, *See* Takeda, Tatsuoki, 15:4156
See Tani, Keiji, 15:4340
Taleyarkhan, R.P., *See* Greene, S.R., 15:2528
Tallman, C.R., Ultrahigh brightness XeCl laser system, 15:3170 (BA;US)
Tam, S.W., Is there a strange attractor in a fluidized bed?, 15:2094 (R;US)
Tamm, E., *See* Quenzel, H., 15:2291
Tamura, K., *See* Suda, T., 15:4074
Tan, M.J., *See* Ishii, M, 15:3187
Tan, Z., Silicide structural evolution in high-dose cobalt-implanted Si(100) crystals, 15:3028 (J;US)
Tanaka, M., *See* Matsuda, Y., 15:4320
Tanaka, Nobuyuki, The design and performance of the FNAL high-energy polarized beam facility, 15:3271 (R;US)
Tanaka, Ryuichi, *See* Mitsui, Hiroshi, 15:2294
Tanaka, S., Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, 15:4319 (R;JP)
Tanaka, T., Examination of Martian sedimentary rocks to understand possible paleo-ocean and its age, 15:3844 (RA;US)

Tang, C.M., *See* Hafizi, B., 15:4456
Tani, B.S., *See* Bloom, I., 15:2945
Tani, K., *See* Kikuchi, M., 15:4333
Tani, Keiji, Ripple loss of alpha particles in ITER, 15:4340 (R;JP)
Tanis, J., *See* Stolterfoht, N., 15:4071
Tanis, J.A., *See* Bernstein, E.M., 15:3926
Tanner, L.E., *See* Rizzo, H.F., 15:2860
Tanner, R.L., *See* Patrinos, A.A.N., 15:3472
Tanner, R.S., *See* Nagle, D.P., 15:3596
Tansy, M.F., Gastric response to methyl methacrylate vapor. Progress report, 15:3769 (R;US)
Tao, W.C., Burning rates of two cast nitramine explosives using a hybrid closed bomb-strand burner, 15:3382 (R;US)
Tapola, M., Displacement ventilation - dimensioning of supply air flow, 15:2683 (R;FI;In Finnish)
Tarasevich, E.L., *See* Krutilina, N.I., 15:3646
Tarbell, J.C., *See* Burgoine, D., 15:2277
Tarrh, J.M., *See* Gaudreau, M.P.J., 15:4458
Tarutin, I.G., *See* Pilyavets, V.O., 15:3672
Taspinar, N., Current measurement studies around the Cesme Peninsula (Turkey), 15:3569 (R;XA)
Tataronis, J.A., *See* Mett, R.R., 15:3940
Tatsumoto, M., U-Th-Pb, Sm-Nd, Rb-Sr, and Lu-Hf systematics of returned Mars samples, 15:3845 (RA;US)
Tatumi, S.H., Dating of aragonite and dolomite from Devil's cave - SP, by dosimetric thermoluminescent method (DTL) and ESR, 15:3057 (R;BR;In Portuguese)
Tauer, K.J., *See* Dowding, R.J., 15:2810
Taulbjerg, K., *See* Hansen, J.P., 15:3924
Tax, W., US and Canadian emissions inventory, 1985. Report for March-September 1988, 15:3442 (R;US)
Taylor, A.J., *See* Tallman, C.R., 15:3170
Taylor, C., *See* Peters, C., 15:3300
Taylor, G., *See* Park, H.K., 15:4351
Taylor, R.E., *See* Ericson, J.E., 15:3364
Taylor, S., *See* Foster, I., 15:4512
Taylor, T.N., *See* Vogt, G.J., 15:2939
Teagan, W.P., *See* Windingland, L.M., 15:2604
Teebor, G.W., Enzymatic repair of oxidative DNA damage, 15:3735 (RA;DE)
Teh, R., Vortex-like and string-like solutions for the 2+1 dimensional SU(2) Yang-Mills theory with the Chern-Simons term, 15:4037 (R;XA)
Telesman, J., *See* Kantzos, P., 15:2974
Telschow, K.L., Dissipation measurement in high T_c superconductors with electromagnetic probes, 15:2916 (R;US)
Process monitoring using optical ultrasonic wave detection, 15:2915 (R;US)
See Garcia, G.V., 15:2834
Tempest, P.A., *See* Jutson, J.A., 15:2815
Ten Brink, H.M., Mineral matter transformations and slagging in a semi-industrial furnace, 15:2100 (R;NL)
Review on mineral matter transformations and slagging in pulverized coal combustion, 15:2099 (R;NL)
Tennery, V.J., *See* Jenkins, M.G., 15:2913
Teoule, R., Free radical and radiation-induced DNA damage to oligonucleotides, 15:3721 (RA;DE)
Terao, Nobuzo, Structure of niobium carbides, 15:2934 (TJ;US)
Terazawa, Hidezumi., Possible measurement of the gravitational acceleration of molecules, atoms, nuclei, elementary particles and antiparticles, 15:3958 (R;JP)
Super-hypernuclei in the quark-shell model, 2, 15:4002 (R;JP)
Terumichi, Y., Electron cyclotron current drive experiments on WT-3, 15:4330 (RA;JP)
Terwilliger, K.M., *See* Krisch, A.D., 15:3281
Teske, E., *See* Arastoopour, H., 15:2137
Tessier, J.H., *See* Forrester, R.J., 15:2502
Texier, N., *See* Robertson, D.W., 15:4520
Tfounni, E., *See* Naal, Z., 15:3053
Thaheem, A.B., *See* Ahsan, J., 15:4274, 15:4280
See Aslam, M., 15:4275
Tham, M.K., *See* Chang, M.M., 15:2115
Thames, J.M., *See* Ayala, R.E., 15:2417
Theissig, W., Studies of the ternary phase diagram U-Pu-O between 1000 and 2000deg C. Structural and physico-chemical properties of $Pu_xU_yO_z$ mixed oxides with a view to applications as fuel, 15:2919 (R;DE;In German)
Theriot, D., *See* Fast, R.W., 15:3333
Thiel, P., *See* Nouvel, P., 15:4517
Thinnes, G.L., Comparison of thermal and mechanical responses of the TMI-2 reactor vessel, 15:2524 (R;US)
Thiroff, P., Angular momentum dependence of the dipole giant resonance in hot nuclei, 15:4102 (RA;DE;In German)
Thivent, M., *See* Arnold, W., 15:3321
Thoft-Christensen, P., Applications of structural systems reliability theory in offshore engineering. State-of-the-art, 15:3255 (R;DK)
Thomalla, E., *See* Quenzel, H., 15:2291
Thomas, D.K., *See* Poker, D.B., 15:2940
Thomas, D.L., *See* Nanstad, R.K., 15:3215
Thomas, G., *See* Lin, K.C., 15:4521
Thomas, I.M., Single layer $Al_2O_3 \cdot H_2O$ and multilayer $Al_2O_3 \cdot H_2O$–SiO_2 optical coatings prepared from colloidal suspensions, 15:3020 (J;US)
Thomas, J., Testing the inverse-square law of gravity: Error and design with the upward continuation integral, 15:3877 (J;US)
Thomas, J.D., *See* Sherman, D.H., 15:2827
Thomas, M., Use of micrometeorological parameters in the establishment of a VOC (volatile organic compounds) monitoring network. Technical report (Final), 15:3454 (R;US)
See Mortazavi, P., 15:3284
Thomas, P., *See* Gaudreau, M.P.J., 15:4458
Thomas, S.J., *See* Rosocha, L.A., 15:4453
Thomassen, K., Applications of free-electron laser technology to magnetic fusion, 15:4481 (J;US)
Thomassen, K.I., *See* Hooper, E.B., 15:4352
See Tanaka, S., 15:4319
Thomassen, S., *See* Melke, J., 15:3235
Thome, R.J., *See* Pillsbury, R.D. Jr, 15:4471
See Pillsbury, R.D. Jr., 15:4474
Thompson, A.G., *See* Fraas, L.M., 15:2319
Thompson, A.R., *See* Carrado, K.A., 15:2992
Thompson, G., *See* Birmingham, D., 15:4041
Thompson, K.M., Quadrupole magnet for the APS [Advanced Photon Source] storage ring, 15:3317 (R;US)
Thompson, L.J., *See* Eastman, J.A., 15:4206
See Rothman, S.J., 15:2914
Thompson, M.O., *See* Stiffler, S.R., 15:2998
See Tsao, J.Y., 15:3000
Thompson, P., *See* Herrera, J., 15:3327
Thompson, R.L., *See* Moorhead, P.E., 15:3245
Thompson, S., *See* Gillies, G.T., 15:3211
Thomson, S.L., *See* Lousteau, D.C., 15:4387
Thomson, W.W., Plant senescence: Its biochemistry and physiology, 15:3601 (B;US)
Thor, S.E., Evaluation of the relation (coherence) between wind speed and various set parameters at the Naesudden wind power plant, 15:2386 (R;SE;In Swedish)
Thorn, R.J., *See* Porter, L.C., 15:4252
Thornhill, R.E., *See* Knox, C.A., 15:2440
Thornton, C.P., *See* Alexander, S.S., 15:3814
Thornton, M.A., *See* Joyce, J.P., 15:2650, 15:2651
Thorpe, R.K., *See* Heuze, F.E., 15:2148
Thresh, H.R., *See* Wiencek, T.C., 15:2164
Thresher, R., Prediction of stochastic blade responses using a filtered noise turbulence model in the FLAP code, 15:2393 (BA;US)
Thresher, R.W., *See* Hock, S.M., 15:2404
See Wright, A.D., 15:2392
Thullen, P., Status of the design and construction of the CPRF and the ZTH reversed field pinch experiment, 15:4360 (BA;US)
Thurnau, R.C., Incinerability index: A measure of incinerator performance, 15:2743 (R;US)
Thurston, G., *See* Smith, J.P., 15:4410
Thurston, L., *See* Harris, W.M., 15:2106
Tichler, J., Radioactive materials released from nuclear power plants: Annual report, 1987, 15:2540 (R;US)

Tiedemann, R.B., Selection with minimal bias, of an experimental control from natural wetland environments. Technical report (Final), 15:3576 (R;US)
Tiegs, T.N, Protective coating for alumina-silicon carbide whisker composites, 15:3037 (P;US)
Tiemersma, D.N., *See* Okken, P.A., 15:2599
Tietbohl, G.L., *See* Christie, D.J., 15:4442
Tietjen, G.L., *See* Burkhalter, H.E., 15:4487
Tikkanen, P., Ecological aspects of lake regulation in northern Finland. Part 3. Macrozoobenthos and feeding of fish, 15:2288 (R;FI;In Finnish)
See Alasaarela, E., 15:2290
Tillotson, T., *See* Hair, L.M., 15:2986
Timmons, M.L., *See* Solomon, G.S., 15:3013
Timpf, J., *See* Zasadzinski, J.F., 15:4254
Ting, A., *See* Hafizi, B., 15:4456
Tinschert, K., *See* Muller, A., 15:3917
Tipton, M.T., *See* Mcknight, R.L., 15:3241
Tischler, J.Z., *See* Buschert, J.R., 15:3017
See Larson, B.C., 15:2999
Tishenko, N.A., *See* Kovalev, A.I., 15:3661
Tkachev, S.I., *See* Isaev, I.G., 15:3643
Tkachev, S.I. and others, *See* Goldobenko, G.V., 15:3666
Tobey, R.A., *See* Shackelford, M.E., 15:3764
Tobin, M.J., Neutronics issues for a laboratory microfusion facility, 15:4479 (BA;US)
Tobin, M.T., Laboratory microfusion facility -- Neutronics and radiological safety analysis, 15:4449 (R;US)
Neutronics issues for starlight: An inertial confinement fusion reactor concept, 15:4447 (R;US)
Toby, B.H., *See* Egami, T., 15:2905
Todd, E.S., Three-dimensional inelastic analysis methods for hot section components, 15:3237 (RA;US)
Todd, J.F., Atmospheric depositional characteristics of Beryllium 7 and Lead 210 along Southeastern Virginia coast, 15:3490 (J;US)
Toelg, S., *See* Achenbach, W., 15:4117
Toersiev Jensen, P., *See* Kampp Rasmussen, N.B., 15:3113
See Olsen, A., 15:3110
Toews, H., *See* Kruechten, B. v., 15:3338
Toke, J., Correlations between fragment mass and excitation energy in damped reactions, 15:4168 (J;US)
Tokuda, Shinji, *See* Ozeki, Takahisa, 15:4425
Tomic, J., *See* Schobert, H.H., 15:2025
Tomura, Kenji, Proceedings of Institute for Atomic Energy, Rikkyo University (IAERU) seminar-4, 15:4486 (R;JP)
Tomutsa, L., *See* Chang, M.M., 15:2115
Tong, M., *See* Moorhead, P.E., 15:3245
Toorman, A.F., *See* Wierenga, P.J., 15:2218
Torres, A.L., Tropospheric nitric oxide measurements, 15:3418 (RA;US)
Tosa, Y., Global gauge anomalies for theories with the Green-Schwarz local-anomaly-cancellation mechanism, 15:4055 (J;US)
See Okubo, S., 15:4027
Tosi, M.P., *See* Akdeniz, Z., 15:4218
See Badirkhan, Z., 15:4217
See Miesenboeck, H.M., 15:4219
Tossi, A.B., Interaction of ruthenium complexes with nucleic acids. DNA damage via sensitized radical production, 15:3733 (RA;DE)
Toth, L., *See* Lechter, W., 15:2965
Toth, R.P., *See* Bacon, L.D., 15:3227
Tourillon, G., *See* Tan, Z., 15:3028
Toussaint, D., *See* Gottlieb, S., 15:4060
Tracey, T.R., Potential of advanced-design solar central receiver power systems, 15:2321 (BA;US)
Trager, E, *See* Coffman, F., 15:2537
Traishawala, N., *See* Zasadzinski, J.F., 15:4254
Tratnik, M.V., *See* David, D., 15:4285
Trauth, M.G., *See* Brucker, A., 15:4109
Trautmann, D., *See* Baur, G., 15:4077
Travis, B.J., *See* Birdsell, K.H., 15:2204
Travis, C.C., *See* Hattemer-Frey, H.A., 15:3758
Trazska, M., *See* Gnirs, M., 15:4096
Trebino, R., A new nonlinear-optical perturbation expansion and diagrammatic approach, 15:3900 (J;US)
See Rahn, L.A., 15:3901
Trehan, M.F., *See* van der Heijde, P.K.M., 15:3557
Treiman, A.H., Crystal fractionation in the SNC meteorites: Implications for sample selection, 15:3846 (RA;US)
Trim, M.J.B., Space and hot water heating: energy-efficiency in large gas-fired systems, 15:2663 (R;GB)
Trincat, B., *See* Arnold, W., 15:3321
Trofe, T.W., Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report, 15:2143 (R;US)
Troiano, J., *See* Jacobson, J., 15:3404
Trombka, J.I., *See* Lo, I.Y., 15:3355
Trott, W.M., *See* Skocypec, R.D., 15:3381
Truesdell, A.H., *See* Aunzo, Z., 15:2355, 15:2356
Truran, J.W., *See* Starrfield, S., 15:3875
Trzaska, M., *See* Pelte, D., 15:3339
Tsai, C.C., *See* Gouge, M.J., 15:4388
Tsai, S.Y., *See* Chiu, Shen-yann, 15:3495
Tsang, W., *See* Herron, J.T., 15:3107
Tsangarakis, N., Fracture-toughness testing of metal-matrix composites, 15:2966 (R;US)
Tsao, J.Y., Interface velocity transients during melting of a-Si/c-Si thin films, 15:3000 (BA;US)
See Dodson, B.W., 15:3009
Tschesche, S., *See* Breitbach, G., 15:4105
Tsipis, K., *See* Sastry, M.A., 15:2804
Tsou Sheungtsun, *See* Bordes, J., 15:4045
See Chan Hongmo, 15:4046
Tsuchiya, Akihiko, *See* Nishioka, Tsuyoshi, 15:4022
Tsukuma, Hidehiko., *See* Sakata, Fumihiko, 15:4152
Tsumori, K., Phase properties of the rapid cooled palladium-silicon alloy in the concentration range 40 to 58 at.% Si, 15:2851 (R;JP)
Tsunematsu, Toshihide, *See* Ozeki, Takahisa, 15:4425
Tsunoda, N., *See* Arai, T., 15:3804
See Miyahara, K., 15:2224
Tsunoda, Naomi, *See* Idemitsu, Kazuya, 15:2223
Tsuruno, Akira, Neutron radiography of the irradiated nuclear fuels, 15:2477 (RA;JP;In Japanese)
Tucker, T.K., Operating and environmental characteristics of Sigma Tau hydrogen masers used in the Very Long Baseline Array (VLBA), 15:3162 (RA;US)
Tuffs, R., *See* Innes, D., 15:3822
Tull, D.E., *See* Summers, J.R., 15:3801
Tulmann Neto, A., *See* Menten, J.O.M., 15:3686
Tulowitzki, H., *See* Hesse, D., 15:2103
Tummillo, A.F., *See* DeLuca, W.H., 15:2582
Tung, C.J., Ionization yields in hydrocarbons under electron irradiation, 15:3101 (J;US)
Tung, Wu-Ki, *See* Olness, F.I., 15:3983
Turchi, P.E.A., *See* Wachs, A.L., 15:4258
Turkevich, A.L., *See* Economou, T.E., 15:3831
Turkiewicz, I., *See* Becker, K., 15:4136
Turnbull, D., *See* Lu, G.Q., 15:2995
Turner, L.R., Computation of electromagnetic effects in a tokamak due to a plasma disruption, 15:4303 (R;US)
See Thompson, K.M., 15:3317
Turski, A., *See* Gunion, J.F., 15:4029, 15:4030
Tweed, E.D., Knowledge-based system: Voltage and VAR [volt-ampere-reactive] dispatch: Final report, 15:2411 (R;US)
Tyler, L.D., *See* Nowak, E.J., 15:2236
Tyler, S., *See* Wilson, D., 15:2622
Tyner, C.E., *See* Tracey, T.R., 15:2321
Tzach, D., Phase conjugate reflection of electromagnetic waves from a plasma, 15:4363 (BA;US)

U

Ubbes, W.F., Application of the results of excavation response experiments at climax and the Colorado School of Mines to the development of an experiment for the underground research laboratory, 15:2237 (R;US)
Uchida, Takao., *See* Tachikawa, Katsuhiro, 15:4424
Udseth, H.R., *See* Smith, R.D., 15:3371

Ueda, Taishi, Dynamic aspects of radioactive contamination of marine organisms. Proceeding of the 14th NIRS seminar on environmental research, 15:3570 (R;JP;In Japanese)
Uesugi, Y., High density current drive experiments on JFT-2M, 15:4321 (RA;JP)
Ueyama, K.I., *See* Naoi, K., 15:2571
Ukai, S., *See* Bottcher, J.H., 15:2463
Ulitskij, I.I., *See* Muravskaya, G.V., 15:3649
Ullal, H.S., US polycrystalline thin film solar cells program, 15:2308 (R;US)
Ullian, L.J., *See* Joyce, J.P., 15:2650, 15:2651
Umstadter, D., The coupling of stimulated Raman and Brillouin scattering in a plasma, 15:4353 (R;US)
Uralil, F., *See* Cassady, M., 15:2150
Uramoto, Joshin., *See* Jimbo, Kouichi, 15:4349
Ussing, V., *See* Andersen, S., 15:2352
Usui, Katsutomi, *See* Matsuoka, Mamoru, 15:4422

V

Vaccaro, R.F., *See* Ketchum, B.H., 15:3574
Vager, Z., *See* Belkacem, A., 15:4210
Vakker, A.V., Influence of local UHF-hyperthermia on frequency of postradiation larynx chondroperichondrites, 15:3659 (RA;SU;In Russian)
See Puchinina, E.A., 15:3664
Valdez, G.D., *See* Lorence, L.J. Jr., 15:3894
Vallante, D., *See* Caplan, P.E., 15:3456
Valic, F., Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)
Valkenburg, C.A., *See* Chiang, T.C., 15:3583
Valverde, N.J., Acute radiation syndrome in the ^{137}Cs Brazilian accident, 1987, 15:3698 (R;BR)
Van Arsdall, P.J., *See* Christie, D.J., 15:4442
Van Dam, J.W., *See* Fu, G.Y., 15:4308, 15:4374
Van Den Avyle, M.J., *See* Bozeman, E.L. Jr., 15:3536
van der Heijde, P.K.M., Establishment of a Ground Water Research Data Center for validation of subsurface flow and transport models. Final report, August 1986-November 1988, 15:3557 (R;US)
van der Lugt, W., *See* Reijers, H.T.J., 15:2887
Van der Wal, J.F., Investigation of the indoor air quality of renovated houses in Bois-le-Duc, Netherlands, 15:2704 (R;NL;In (In Dutch))
Van Dongen, J.E.F., *See* Van der Wal, J.F., 15:2704
Van Kote, F., Disposal in granite formations, 15:2197 (R;FR;In French)
Van Tuyle, G.J., Development and Testing of a RETRAN/MINET composite code and application to the J.A. Fitzpatrick plant, 15:2496 (R;US)
Summary of advanced LMR [Liquid Metal Reactor] evaluations: PRISM [Power Reactor Inherently Safe Module] and SAFR [Sodium Advanced Fast Reactor], 15:2546 (R;US)
Van Voris, P., *See* Cataldo, D.A., 15:3463
Van Wolferen, J., *See* Brand, R.A., 15:2702, 15:2703
VanDenAvyle, J.A., Fatigue characterization of a VAWT blade material, 15:2396 (BA;US)
Vandergrift, G.F., Target and method for the production of fission product molybdenum-99, 15:3105 (P;US)
Vandermeulen, J., *See* Cugnon, J., 15:4173
Vankuiken, J.C., *See* McGowin, C.R., 15:2078
Vann Bush, P., *See* Snyder, T.R., 15:2423
Vanstone, R.H., *See* Kim, K.S., 15:3246
Varadarajan, V., Ash and burn control through fishbones, 15:4302 (R;US)
Control of ash accumulation by induced-fishbones, 15:4398 (R;US)
Varley, B.J., *See* McNeill, J.H., 15:4101
Varma, R, *See* Vandergrift, G.F., 15:3105
Varsamis, G.L., *See* Kelleher, W.P., 15:4435
Vasconcellos, M.B.A., Activities of the neutron activation analysis laboratory of the radiochemistry division of IPEN - CNEN/SP, 15:4494 (R;BR;In Portuguese)
See Armelin, M.J.A., 15:3048
Vashishta, P., *See* Degani, M.H., 15:2910
See Kalia, R.K., 15:4208
Vasil'ev, Yu.D., *See* Rabkin, I.Kh., 15:3632
Vaught, C.C., Evaluation of emission sources from creosote wood-treatment operations. Final report, 15:2747 (R;US)
Vautherin, D., High density matter state equation and phase transitions, 15:4003 (R;FR;In French)
See Kerman, A.K., 15:4051
Vavelidis, M., *See* Chalkias, S., 15:3493
Veal, B.W., *See* Beno, M.A., 15:4249
Vecci, S.J., *See* Clark, G.A., 15:2096
Veers, P.S., Simplified fatigue damage and crack growth calculations for wind turbines, 15:2397 (BA;US)
Three-dimensional wind simulation, 15:2395 (BA;US)
See Dohrmann, C.R., 15:2401
Velikonja, L., Production of coke with specific metallurgical properties. Analysis of conditions in the blast furnace, 15:2029 (R;DE;In German)
Vena, F., *See* Tax, W., 15:3442
Venkatadri, R., *See* Morsi, B.I., 15:2015
Venkateswariu, P., Laser diagnostics of mineral matter and combustion processes in coal: Research report, September 1, 1988–January 31, 1989, 15:2097 (R;US)
Venturini, E.L., *See* Moreland, J., 15:2950
Verdon, C.P., *See* Marshall, F.J., 15:4484
Verhagen, L., *See* Boonekamp, P.G.M., 15:2619
Veselka, T.D., *See* McGowin, C.R., 15:2078
Vessely, V., Experiences of DOAS technique for flue gas measurements, 15:3467 (R;SE;In Swedish)
Vetter, J., *See* Hentschel, D., 15:3624
Vetterli, D., *See* Baur, G., 15:4077
Viani, B.E., *See* Worlery, T.J., 15:2238
Viesti, G., Shapes of ^{59}Cu nuclei at moderate excitation energies and spin, 15:4091 (J;US)
Vigil, M.J., *See* McElroy, D.L., 15:2186
Vigon, B.W., *See* Moss, R.D., 15:2413
Vilim, R.B., *See* Planchon, H.P., 15:2500
Vine, E., *See* Goldman, C.A., 15:2624
Vinson, J., *See* Wierenga, P.J., 15:2218
Vinson, T.S., *See* Heinicke, J.J., 15:2980
Vinyard, S., *See* Beaty, K., 15:2783
Vismara, L., *See* Bertrand, C., 15:3331
Vissers, D.R., *See* Redey, L., 15:2575
See Vandergrift, G.F., 15:3105
Viswambharan, K.R., *See* Nambi, K.S.V., 15:4183
Vleeskens, J.M., *See* Ten Brink, H.M., 15:2100
Vlieg, E., *See* Headrick, R.L., 15:3006
Voegler, N., *See* Khan, S., 15:4072, 15:4089
See Reiner, K., 15:4085
Voelk, H.J., Cosmic ray spectrum produced by supernova remnants with an upper limit on wave dissipation, 15:3824 (RA;DE;In German)
See Drury, L.O'C., 15:3823
Voelund, P., Generation of fatigue loads on Windane 40/2, 15:2382 (R;DK;In Danish)
Vogt, G.J., Plasma synthesis and characterization of ultrafine SiC, 15:2939 (BA;US)
Vogt, H., *See* Korsch, W., 15:3322
Voigtlander, B., Phonon dispersion measurements and first-principles calculations for the Au(110) surface, 15:2895 (J;US)
Volin, K.J., *See* O'Hare, P.A.G., 15:2968
See Reijers, H.T.J., 15:2887
Vollmer, E., Calculations on a third order energy focusing time-of-flight mass spectrometer, 15:3352 (RA;DE;In German)
See Kissel, J., 15:3349
von Brentano, P., *See* Casten, R.F., 15:4172
Vonach, H., *See* Meadows, J.W., 15:4111
Vorbach, J., *See* April, R., 15:2771
See Berlow, J.R., 15:2764, 15:2772
Vorres, K.S., Gas content in sealed Argonne Premium Coal Samples, 15:2051 (R;US)
Voss, C.F., *See* Johnson, K.I., 15:2227
Voter, A.F., *See* Cohen, J.M., 15:3093
Vuuridel, B., *See* Krisch, A.D., 15:3281

Vukovich, F.M., Effects of wind and Gulf Stream events on the currents off the coast of North Carolina as it relates to oil-spill risk potential, 15:2128 (R;US)

W

Waagepetersen, G., Flywheel for vehicles, 15:2562 (R;DK;In Danish)
Wachs, A.L., Electron-positron momentum distribution measurements of high-T superconductors and related systems, 15:4258 (R;US)
Wachsmuth, J., *See* May, B., 15:2278
Wada, Nobuo, Transportable thermal neutron radiography devices, 15:2253 (RA;JP;In Japanese)
Wadkins, R.P., *See* Oh, C.H., 15:4404
Waenke, H., Overview of Mars: SNC meteorite results, 15:3847 (RA;US)
Waganaar, W.J., *See* Rej, D.J., 15:4428
Wagner, E.J., *See* Rondorf, D.W., 15:2279
Wagner, G.A., *See* Lorenz, I., 15:3059
See Petzold, R., 15:3061
See Sauer, W., 15:3060
Wagner, G.J., *See* Reiner, K., 15:4085
Wagner, J.H., *See* Hajek, T.J., 15:3201
Wagner, J.S., RLA simulations, 15:3274 (R;US)
Wagner, K.C., An overview of BWR Mark-I containment venting risk implications, 15:2542 (R;US)
Wagner, M., *See* Meadows, J.W., 15:4111
Wagner, R.G., Search for supersymmetric particles at CDF, 15:3974 (R;US)
Wagner, W.J., Experimental investigations of the rotor loads and the rotor-induced flow of a two-bladed wind turbine model in the low speed wind tunnel of DLR, 15:2378 (RA;DK)
Wahba, A.B., *See* Modro, S.M., 15:2551
Wainright, T., *See* Hrubesh, L.W., 15:2987
Wajchenberg, B.L., *See* Borghi, V.C., 15:3621, 15:3623
Wakabayashi, Hidetaka, *See* Baba, Mamoru, 15:4119
Wakatani, M., *See* Nakamura, Y., 15:4346
Walata, S.A., Source characterization and control technology assessment of methylene chloride emissions from Eastman Kodak Company, Rochester, NY. Final report, July 1988-April 1989, 15:3452 (R;US)
Wald, P.H., A review of the literature on the toxicity of rare-earth metals as it pertains to the Engineering Demonstration System surrogate testing, 15:3792 (R;US)
Walden, R., Ground water protection efforts in four new england states. Technical report, 15:3588 (R;US)
Waldman, D.J., Caterpillar 3406 spark-ignited natural-gas-engine emissions on EPA (Environmental Protection Agency) heavy-duty transient test cycle. Topical report, March-December 1988, 15:2801 (R;US)
Walecka, J.D., Outlook and perspectives (excited baryons, 1988), 15:3948 (R;US)
Waleh, N.S., Genetic engineering of single-domain magnetic particles. Progress report, 1 March-15 June 1989, 15:3611 (R;US)
See Berson, A.E., 15:3610
Walker, D.G., Proceedings of the conference: reclamation, a global perspective, 15:2079 (R;CA)
Walker, K.P., Constitutive modelling of single crystal and directionally solidified superalloys, 15:2843 (RA;US)
Walker, R.B., Direct determination of scattering time delays using the *R*-matrix propagation method, 15:3931 (J;US)
Wall, M.A., *See* Rizzo, H.F., 15:2860
Wallace, A., Adjustable speed drive study, June 1985–September 1988: Part 2, Appendices, 15:3224 (R;US)
Wallace, R.W., *See* Gerstenberger, D.C., 15:3144
Wallerstein, E, *See* Christie, D.J., 15:4442
Wallo, A. III, *See* Yu, C., 15:2183
Walls, B., *See* Sherwood, C.R., 15:3819
Walsh, D., *See* Knapp, J.A., 15:2853
Walsh, W., *See* Ratner, E.Z., 15:2576
Walsh, W.J., *See* Marr, W.W., 15:2583
Walter, J.B., *See* Telschow, K.L., 15:2915
Walters, E.J., Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering center programs, January-March 1989, with 1989 CEEE events calendar, 15:3133 (R;US)
Walters, M., Effects of normal annealing cycles during IGFET fabrication on initial and radiation-induced gate-insulator defects. Annual progress report, 1 December 1988-7 July 1989, 15:3328 (R;US)
Walther, V.H., *See* Khan, S., 15:4072
Wanderer, P., *See* Herrera, J., 15:3327
Wands, R.H., *See* Fast, R.W., 15:3333
Wang, Engineering Assignment 5, E-4B surveillance methodology. Final report, 15:3386 (R;US)
Wang, A., *See* Blakers, A.W., 15:2318
Wang, C.Y., Analysis of fluid-structure interaction and structural response of Chernobyl-4 reactor, 15:2503 (R;US)
Wang, J.A., *See* Kam, F.B.K., 15:2510
Wang, R.T., Operational parameters for the superconducting cavity maser, 15:3161 (RA;US)
Wang, T.F., Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures, 15:4082 (J;NL)
Wang, T.K., *See* Chen, C.C., 15:2559
Wang, Xin-nian, *See* Hwa, R.C., 15:3979
Wang, Y.D., Impact-parameter treatment of high-velocity electron capture from diatomic molecules at fixed orientation, 15:3920 (J;US)
Wang, Z.Z., *See* Wachs, A.L., 15:4258
Wanlass, M.W., An empirical investigation of the InP shallow-homojunction solar cell, 15:2314 (BA;US)
See Coutts, T.J., 15:2317
Ward, B., Relationships between natural weathering and lignite biosolubility or alkali solubility, 15:2063 (R;US)
See Yeh, G.J.C., 15:2062
Ward, S.J., *See* Kay, B.D., 15:3094
Warde, C.J, *See* Henriksen, G.L., 15:2588
Warde, C.J., *See* Henriksen, G.L., 15:2790
See Ratner, E.Z., 15:2576
Wardman, P., The competition between oxidants (radiosensitizers) and reductants (radioprotectors) in modifying free-radical damage to DNA, 15:3710 (RA;DE)
Warner, D.D., *See* Zhang, J.-Y., 15:4125
Warpinski, N.R., Altered-stress fracturing, 15:2117 (J;US)
Warren, M.F., *See* Whitfield, R.G., 15:4505
Warren, R.W., High-field pulsed microwigglers, 15:3157 (R;US)
Lasing on the third harmonic, 15:3156 (R;US)
See Goldstein, J.C., 15:3158
Waszczak, J.V., *See* Dessau, D.S., 15:2956
Watanabe, S., *See* Deus, S.F., 15:4189
Watanabe, Takao, Development of high-efficiency molten carbonate fuel cell. Evaluation of stack performance and clarification of degradation mechanism at high fuel utilization, 15:2656 (R;JP;In Japanese)
Watanabe, Yasuo, Spectral characteristics of arc-heated low density plasma flows (3). Helium plasma, 15:3892 (R;JP;In Japanese)
Watanabe, Yukinobu, *See* Koori, Norihiko, 15:4427
Waters, M.D., Genetic activity profiles: Use in management of risk from genotoxic substances in the environment, 15:3766 (R;US)
Genetic-activity profiles and hazard assessment, 15:3768 (R;US)
Use of genotoxic activity profiles in assessment of carcinogenesis and transmissible genetic effects, 15:3775 (R;US)
Watson, D.L., *See* Klopcic, J.T., 15:3385
Watson, J.E., *See* Adams, F.D., 15:4185
Watson, L.T., *See* Ribbens, C.J., 15:4508, 15:4513
Watson, R.E., *See* Bennett, L.H., 15:2812
Watts, R.R., Use of bioassay methods to evaluate incinerator emissions, 15:3440 (R;US)
Weathersby, P.K., Robust spatial calibration of a planar positron camera. Final report, October 1985-September 1987, 15:3614 (R;US)
Weaver, H.T., *See* Lott, J.A., 15:3004
Weaver, T., *See* May, B., 15:2278
Weber, E.R., *See* Khachaturyan, K., 15:3029
See Khachaturyan, K.A., 15:3010
See Tracey, T.R., 15:2321
Weber, M.J., Laser glass (1989), 15:3168 (R;US)

Weber, T., (e,e'f) coincidence experiments for fission decay of giant resonances in $^{235,238}U$, 15:4113 (RA;DE;In German)
Weber, W., *See* Zhao, G., 15:2892
Weber, W.J., *See* Bates, J.L., 15:2659
Webster, C.E, *See* DeLuca, W.H., 15:2582
Webster, C.E., *See* DeLuca, W.H., 15:2574
Wefers, H., Hints and search strategies for the substances listed in the Accident Ordinance, 15:3803 (R;DE;In German)
Wegner, K., *See* Schoenfeld, R., 15:4544
Wegner, P., System software for Soviet computers, 15:4526 (R;US)
Wehner, A.P., Asbestos cement dust inhalation by hamsters, 15:3793 (J;US)
Wei Dongping, *See* Zhou Huilan, 15:3809
Wei, T.Y.C., *See* Sackett, J.I., 15:2507
Weichler, C., *See* May, B., 15:2278
Weidenmueller, H.A., *See* Bohigas, O., 15:4140
See Egido, J.L., 15:4150
See Habs, D., 15:3270
See Nishioka, H., 15:4141, 15:4143
See Pluhar, Z., 15:4142
Weiler, B.H., The reactions of iron clusters with water, 15:3091 (J;US)
Weinberg, B.C., *See* Buggeln, R.C., 15:3200
Weinberger, P.J., *See* Wegner, P., 15:4526
Weinell, C.E., *See* Dam-Johansen, K., 15:3419
Weinert, M., *See* Fernando, G.W., 15:4247
See Smith, N.V., 15:2890
Weingart, R.C., *See* Gathers, G.R., 15:3221
Weinstein, A.J., *See* Gunion, J.F., 15:4059
Weinstein, H., *See* Osman, R., 15:3703
Weirick, L.J., Shock-wave characterization of energetic booster-rocket propellant WAK-2 and its simulant UGS, 15:2260 (R;US)
Weisberg, R.H., *See* Vukovich, F.M., 15:2128
Weitzman, L., *See* Harmon, D.L., 15:3441
Welch, W.F., *See* Smith, D.M., 15:2344
Wells, B.O., *See* Dessau, D.S., 15:2956
See Shen, Z., 15:2960
Welp, U., *See* Shi, D., 15:2947
Welti, K., *See* Baumann, W., 15:3293, 15:3294, 15:3345, 15:3889, 15:3890
Wen, S., *See* Khan, S., 15:4135
Wendel, S., *See* Hagen, U., 15:3706
Wendelin, T.J., LANSIR: An instrument for measuring the light-scattering properties of laminate membrane mirrors, 15:2350 (BA;US)
Wentz, C.A., *See* Peters, R.W., 15:3041
Werley, K.A., A high-speed beam of lithium droplets for collecting diverted energy and particles in ITER [International Thermonuclear Experimental Reactor], 15:4430 (R;US)
See Cooke, P.I.H., 15:4469
See Krakowski, R.A., 15:4342
Werner, U., *See* Poertner, R., 15:2757
Wesley, J.C., *See* Sayer, R.O., 15:4301
Wesselborg, C., *See* Zhang, J.-Y., 15:4125
Wessels, J., *See* Pelte, D., 15:3339
West, R.A., *See* Belton, M.J.S., 15:3867
West, R.N., *See* Wachs, A.L., 15:4258
Westermark, M., Separation of wood chips for energy production, 15:2275 (R;SE;In Swedish)
Westin, S.C., *See* Host, G.E., 15:2298
Westling, O., Monitoring of air pollution in the southern counties, 15:3478 (R;SE;In Swedish)
Westmacott, K.H., *See* Dahmen, U., 15:2841
Weston, R.E. Jr., Energy transfer studies with lasers, 15:3904 (J;US)
See Hershberger, J.F., 15:3933
Westrum, E.F. Jr., Thermophysical properties of the lanthanide sesquisulfides. I. Schottky functions and magnetic and electronic properties of γ-La_2S_3, γ-Ce_2S_3, γ-Nd_2S_3, and γ-Gd_2S_3, 15:3021 (J;US)
Wetch, J.R., Megawatt class nuclear space power systems (MCNSPS) conceptual design and evaluation report. Volume 2, technologies 1: Reactors, heat transport, integration issues. Final report, 15:2464 (R;US)
Whalley, P., *See* Bernard, M.J. III, 15:2605
Whangbo, Myung-Hwan, Linear electron-hole-electron pair model of high-temperature superconductivity in $La_{2-x}M_xCuO_4$ and $YBa_2Cu_3O_{7-y}$: 2, Dependence of the superconducting transition temperatures on pressure and on hole concentration, 15:4251 (R;US)
Wheeler, F.J., *See* Parsons, D.K., 15:2490
Whitaker, R.B., Simultaneous thermal analysis techniques for characterization of energetic materials, 15:3380 (R;US)
White, A.R., Low $m_0$perpendicular properties of the pomeron: Theoretical implications in QCD, 15:4047 (BA;US)
White, C.W., *See* McHargue, C.J., 15:2907, 15:2908, 15:2936
See Rankin, J., 15:2941
White, J.D., [Halden Reactor Project and DOE's Advanced Controls Program: Foreign trip report, October 16, 1989–October 22, 1989, 15:2481 (R;US)
White, R.M., Evaluation of hypotheses for the cause of the 1886 Charleston earthquake: Final report, 15:3813 (R;US)
Whitehouse, D.A., Radiative kaon capture at rest in hydrogen, 15:3971 (J;US)
Whitenton, E.P., Computer-controlled test system for operating different wear-test machines, 15:3216 (R;US)
Whitfield, R.G., IDEA—Interactive Decision Analysis: Users' guide and tutorial, 15:4505 (R;US)
Whitley, R., *See* Moses, G.A., 15:4461
Whitman, D., Hostile intelligence threat: US technology, 15:2611 (R;US)
Whitten, J.E., *See* Young, C.E., 15:4209
Whittum, D.H., *See* Sessler, A.M., 15:3272
Whitty, S., *See* Morris, F.W., 15:2978
Whuk, M., *See* Combs, J., 15:3580
Wichlacz, P.L., *See* Gianotto, A.K., 15:2832
See Pryfogle, P.A., 15:3546
Wickenhaeuser, A., Algorithms and programs for evaluating fault trees with multi-state components, 15:4519 (R;DE;In German)
Wiedeman, S., *See* Ayra, R.R., 15:2305
See Carlson, D.E., 15:2303
See Catalano, A.W., 15:2304
Wiederhold, G., *See* Wegner, P., 15:4526
Wiedner, C.A., *See* Gyufko, R., 15:4090, 15:4092, 15:4093
See Kruechten, B. v., 15:3338
Wiel, S., *See* Goldman, C.A., 15:2624
Wieland, R.M., *See* Park, H.K., 15:4350
Wiencek, T.C., Status of high-density fuel plates fabrication: Final draft, 15:2164 (R;US)
Wierenga, P.J., Soil physical properties at the Las Cruces trench site, 15:2218 (R;US)
Wight, J., *See* Hong, R., 15:4415
Wilder, M.E., *See* Carpenter, S., 15:3754
Wile, J.L., Excitation energy equilibration in damped $^{139}La+^{40}Ar$ collisions at 15 MeV per nucleon, 15:4100 (J;US)
Wilhelmy, J.B., *See* Achenbach, W., 15:4117
Wilhite, A.W., *See* Joyce, J.P., 15:2650, 15:2651
Wilke, W., *See* Weber, T., 15:4113
Wilkes, J.S., Nuclear magnetic resonance in molten salts, 15:4202 (R;US)
Wilkins, B.T., Investigations of iodine-129 in the natural environment: results and implications, 15:2241 (R;GB)
Wilkins, D.A., *See* Overbey, W.K., 15:2147
Wilkins, J.W., *See* Levine, Z.H., 15:4289
Wilkins, M.E, *See* George, M., 15:4534
Wilkins, S.C., Low cross-section Mo-Nb thermocouples for nuclear application: The state-of-the-art, 15:2831 (R;US)
Wilks, S.C., A photon accelerator, 15:3279 (R;US)
Wille, L.T., Mean-field theory of oxygen-vacancy ordering in $YBa_2Cu_3O_{7-\delta}$, 15:2961 (J;US)
Willen, E., *See* Herrera, J., 15:3327
Williams, D.C., *See* Benvenuti, A., 15:3357
Williams, D.M, Variable loading roller, 15:4533 (P;US)
Williams, G.P., Infra-red synchrotron radiation measurements at Brookhaven, 15:3283 (R;US)
The initial scientific program at the NSLS infrared beamline, 15:4204 (R;US)
Williams, J.M., *See* Porter, L.C., 15:4252
See Whangbo, Myung-Hwan, 15:4251

Williams, K, *See* Mims, J., 15:2494
Williams, L.E., Effects of air pollutants on photosynthesis, vegetative growth, and development of grapevines in the San Joaquin Valley of California. Final report, February 1987-February 1989, 15:3445 (R;US)
Williams, L.R., *See* Hamilton, J.C., 15:2879
Williams, M.C., Environmental aspects of coal-fueled diesel engines, 15:2080 (BA;US)
Williams, R.S., *See* Balik, C.M., 15:3432
Williamson, A.D., Measurement of condensable vapor contribution to PM10 emissions, 15:2696 (R;US)
Wilmoth, R.C., *See* Kominsky, J.R., 15:3437, 15:3438
See Powers, T.J., 15:3256
Wilson, C.T., *See* Shen, S.S., 15:4478
Wilson, D., Policies and programs for promoting energy conservation in the residential sector: Lessons from five OECD [Organization for Economic Cooperation and Development] countries, 15:2622 (R;US)
See Batstone, R., 15:2750
Wilson, D.L., Navy Radon Assessment and Mitigation Program progress report, September 1988–May 1989, 15:2673 (R;US)
See Dudney, C.S., 15:2693
Wilson, J.E., *See* Heinicke, J.J., 15:2980
Wilson, R.B., Three-dimensional inelastic analysis for hot section components, BEST 3D code, 15:3238 (RA;US)
Wilzbach, M.A., *See* Cummins, K.W., 15:3539
Winans, R.E., *See* Botto, R.E., 15:2052
See Carrado, K.A., 15:2992
Windingland, L.M., Review of facility-technology options and their development status. Final report, 15:2604 (R;US)
Winer, K., Band bending and oxygen-induced defects in *a*-Si:H, 15:3007 (J;US)
Winje, R.A., *See* Lennox, A.J., 15:3619
Winkelmann, I., Radionuclide deposition and exposure in the Federal Republic of Germany after the Chernobyl accident, 15:3746 (R;US)
Winkler, G., *See* Meadows, J.W., 15:4111
Winkler, T., *See* Goguen, J.A., 15:4500
Winkler, U., *See* Gnirs, M., 15:4096
See Pelte, D., 15:3339
Winske, D., *See* Omidi, N., 15:4371
Winston, R., *See* O'Gallagher, J., 15:2348
Wintenberg, R.E., *See* Shen, S.S., 15:4478
Winter, K., Effects of acid and lime on mesofauna of forest soils in the laboratory and in the field. Final report, 15:3762 (R;DE;In German)
Wire, M., *See* Arko, A.J., 15:4232
Wiringa, R.B., *See* Pandharipande, V.R., 15:4124
Wirtenson, G.R., *See* Hsieh, E.J., 15:2855
Wirth, H.L., *See* Baumann, H., 15:2254, 15:3291, 15:3292
Wishinsky, B.J., *See* Robertson, D.W., 15:4520
Witcomb, M.J., *See* Dahmen, U., 15:2841
Witebsky, C., *See* Gavin, L.M., 15:3131
Witherspoon, P.A., *See* Aunzo, Z., 15:2355, 15:2356
Withrow, S.P., High energy ion beam annealing in implanted CdTe, 15:2994 (BA;US)
See Ohana, I., 15:2937
Wittenberg, L.J., *See* ElGuebaly, L.A., 15:4467
Wodley, C., *See* Goldman, C.A., 15:2624
Woehler, K.E., Origin of the universe from Quantum Chaos: An introduction to current ideas (professor John Dyer Memorial Lecture). Technical report, 15:3820 (R;US)
Wolcott, P., *See* Wegner, P., 15:4526
Wolf, A., *See* Casten, R.F., 15:4172
Wolf, D., *See* Phillpot, S.R., 15:2821
Wolf, M.A., *See* Nelson, D.C., 15:3482
Wolfenstaetter, H., *See* Pelte, D., 15:3339
Wolff, S., *See* Huebel, K., 15:3567
Wolff, W.F., *See* Gant, K.S., 15:2512
Wolfram, J.H., *See* Pryfogle, P.A., 15:3546
Wolfs, F.L.H., *See* Moore, E.F., 15:4107
Wollersheim, H.J., *See* Gerl, J., 15:4115
See Lubkiewicz, E., 15:4103
Wong, A.Y., *See* Kuthi, A., 15:4382
Wong, C., *See* Hasan, M.Z., 15:4468
Wong, C.C., A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation, 15:2541 (R;US)
Wong, C.P., *See* Sharafat, S., 15:4470
Wong, G.T.F., *See* Todd, J.F., 15:3490
Wong, I., Earthquake strong ground motion studies at the Idaho National Engineering Laboratory, 15:3807 (R;US)
Wong, K.W., *See* Ching, W.Y., 15:3032
Wood, B.D., *See* Habib, H.M., 15:2336
Wood, D.J., A review of assumptions and analysis in EPRI EA-3409: "Household appliance choice: Revision of REEPS [Residential End-use Energy Planning System] behavioral models", 15:2686 (R;US)
A study of aggregation bias in estimating the market for home heating and cooling equipment, 15:2687 (R;US)
Market share elasticities for fuel and technology choice in home heating and cooling, 15:2685 (R;US)
Wood, L., Concerning advanced architectures for strategic defense, 15:2802 (R;US)
Wood, R.L., *See* Wendelin, T.J., 15:2350
Woodland, W.T., *See* Bernstein, E.M., 15:3926
Woodruff, M.G., *See* Keller, J.F., 15:2228
Woodruff, R.K., *See* Haerer, H.A., 15:3749
See Napier, B.A., 15:3750
Woods, D.R., *See* Abratt, V., 15:3598
Woods, P.J., *See* McNeill, J.H., 15:4101
Woodward, E.C., More about breathing on the Mesa, 15:3516 (R;US)
Woodworth, J.R., *See* Ruiz, C.L., 15:3311
Woolf, B., *See* Lesser, V., 15:4498
Worlery, T.J., The EQ3/6 software package for geochemical modeling: Current status, 15:2238 (R;US)
Worlton, T.G., *See* Jorgensen, J.D., 15:3358
Woronick, S.C., Interfacial roughness in InAs/GaAs heterostructures determined by soft x-ray reflectivity, 15:3018 (J;US)
Wos, L., The problem of finding a strategy in control binary paramodulation, 15:4506 (R;US)
Wouters, J.M., *See* Oothoudt, M.A., 15:3297
Woweries, J., *See* Krankowsky, D., 15:3821
Wozniak, G.J., *See* Moretto, L.G., 15:4099
Wren, B.W., *See* Cullis, P.M., 15:3711
Wright, A.D., Prediction of stochastic blade responses using measured wind speed data as input to the FLAP code, 15:2392 (BA;US)
See Hock, S.M., 15:2404
See Thresher, R., 15:2393
Wright, A.F., *See* Baskes, M.I., 15:3024
Wright, D., *See* Wong, I., 15:3807
Wright, I. P., Stable isotopic studies of H,C,N,O and S in samples of Martian origin, 15:3848 (RA;US)
Wright, J., *See* Copeland, R.J., 15:2267
Wright, R.B., *See* Gianotto, A.K., 15:2832
Wroldsen, J., *See* Pirner, H.J., 15:4000
Wruck, D., *See* Rubin, M., 15:2951
Wu, Chun-Der, *See* Plys, M.G., 15:2515
Wu, D.Q., *See* Chu, B., 15:3231
Wu, H., *See* Grigolini, P., 15:4246
Wu, R., Solution of reference interaction site model for mixtures of short-chain polyatomic molecules, 15:3932 (J;US)
Wu, R.-S., *See* Cochran, H.D., 15:3073
Wu, S.F., *See* Narayanan, T.V., 15:2329
Wuebbles, D.J., Ozone and other issues in global atmospheric chemistry, 15:3394 (B;US)
Wuerfels, M., Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)
Wunderlich, R., Development of a laser ion source for xenon, 15:3295 (RA;DE;In German)
Wurm, J.P., *See* Brucker, A., 15:4109
Wurtele, J.S., *See* Fajans, J., 15:3181
See Sessler, A.M., 15:3272
Wurz, A., *See* Ender, C., 15:3343

X

Xavier, A.M., *See* Mezrahi, A., 15:2172
Xu, K., *See* Leibovitch, C., 15:4366
Xu, Y., *See* Ching, W.Y., 15:3032

Y

Yabe, Masayuki, (n,p) reactions and the nuclear structures, 15:4087 (RA;JP)
Yacoby, Y., *See* Shechter, H., 15:2881
Yahaya bin Jafar, Non-destructive radiometry inspection technique for locating reinforcements and void/porosity in bridge bearings, 15:2257 (R;MY)
Yakovenko, T.I., *See* Musaelyan, R.M., 15:4098
Yamada, M., *See* Sato, T., 15:2786
Yamada, O., Kinetics of coal conversion to soluble products: January 1, 1989–June 30, 1989, 15:2019 (R;US)
Kinetics of coal conversion to soluble products: Quarterly report, July 1, 1989–September 30, 1989, 15:2020 (R;US)
Yamada, Y., *See* Noda, Y., 15:2884
Yamagiwa, M., *See* Kishimoto, Y., 15:4334
Yamaguchi, Seiya, Development and application of an on-line tritium production rate measuring method, 15:4421 (R;JP)
Yamamoto, Hisashi., *See* Nishioka, Tsuyoshi, 15:4022
Yamamoto, R., *See* Moses, G.A., 15:4461
Yamamoto, Yoshifumi, *See* Sakata, Fumihiko, 15:4152
Yamamuro, Nobuhiro, Activation cross section data file, 15:4157 (R;JP;In Japanese)
Yamanoi, Y., *See* Shintomi, T., 15:3296
Yamartino, J.M., *See* Benvenuti, A., 15:3357
Yamaura, M., Electrodeposition and evaporation techniques used for preparation of ^{239}Pu sources. Determination by alpha spectrometry, 15:3052 (R;BR;In Portuguese)
Yamazaki, Toshimitsu, Studies of deeply bound π^- states by (n,p) and (d,^{2}He) pion transfer reactions, 15:4110 (RA;JP)
Yamazawa, Hiromi, Verification study of a three-dimensional local scale atmospheric model PHYSIC at seacoast region, 15:3479 (R;JP)
Yan, M., *See* Sevilla, M.D., 15:3714
Yanagi, N., *See* Morimoto, S., 15:4347
Yanagihara, Satoshi, *See* Nakamura, Takehiko, 15:2534
Yanagisawa, Kazuaki, Study on the behavior of PWR remedy fuel under reactivity initiated accident conditions. Effect of pellet shape modification, 15:2533 (R;JP;In Japanese)
Yang, B.X., *See* Woronick, S.C., 15:3018
Yang, L., *See* Ayra, R.R., 15:2305
Yang, R., *See* Klein, W.H., 15:3398
Yang, S., *See* Oldfield, E., 15:2957
Yang, X.Q., Near-edge x-ray-absorption fine-structure spectroscopy investigation of poly(ethylene oxide)-KI complexes, 15:3035 (J;US)
Yao, Jen-Chih, A basic theorem of complementarity for the generalized variational-like inequality problem: Technical report, 15:4529 (R;US)
Generalized quasi-variational inequality and implicit complementarity problems, 15:4528 (R;US)
Yarber, J.L., *See* Schwenterly, S.W., 15:4390
Yas'kevich, L.S., Radioactive colloid gold ^{198}Au in combined treatment of lung cancer, 15:3674 (RA;SU;In Russian)
Yasar, O., Radiological dose calculations for the chamber and diode region of the light ion fusion target development facility, 15:2557 (BA;US)
See Olson, R.E., 15:4477
Yasmin binti Baba, *See* Mohamad bin Harun, 15:2850
Yau, Waifan, Spatially resolved localized vibrational mode spectroscopy of carbon in liquid encapsulated Czochralski grown gallium arsenide wafers, 15:4233 (R;US)
Yavornik, E.J., CPRF/ZTH shell poloidal gap design and fabrication, 15:4460 (BA;US)
Ye, D., *See* Moore, E.F., 15:4107
Ye, L., Electronic structure of kink and kink-antikink defects in polyacetylene, 15:3027 (J;US)
Structural, electronic, and optical properties of polyacetylene from a total-energy local-density molecular-cluster approach, 15:3026 (J;US)
Yeager, K.E., The electric-utility industry perspective, 15:2627 (RA;US)
Yeh, G.J.C., Numerical comparisons between the pyrolysis mass spectra of twelve US coals and their relative solubility in microbial cultures or alkaline buffer, 15:2062 (R;US)
Yetter, R.A., Evaluation of the rate constant for the reaction OH+H_2CO: Application of modeling and sensitivity analysis techniques for determination of the product branching ratio, 15:3087 (J;US)
Yeung, E.S., Polarization spectroscopy in analytical measurements, 15:3067 (J;US)
Yin, E., *See* Rubin, M., 15:2951
Ying, S., Neutrino disintegration of deuterium, 15:3985 (R;US)
Yokobayashi, Masao, BWR plant dynamic analysis code BWRDYN user's manual, 15:2439 (R;JP;In Japanese)
Yokoyama, A., *See* Zhao, X., 15:3098
Yonezu, H. and others, *See* Sakurai, M., 15:4318
York, G.W., Design and operation of high efficiency electron-beam-initiated chemical lasers, 15:3171 (BA;US)
Yoshida, H., *See* Sze, D.K., 15:4393
Yoshida, Kazuo, *See* Yokobayashi, Masao, 15:2439
Yoshida, S., *See* Nishioka, H., 15:4141
Yoshioka, K., Lower hybrid current drive model and its comparison with experiments, 15:4326 (RA;JP)
Yoshioka, Yuji, *See* Hiratsuka, Hajime, 15:4423
Yosoi, M., *See* Suda, T., 15:4074
Yost, A.B., *See* Overbey, W.K., 15:2140, 15:2147
Yost, L.E., *See* Overbey, W.K., 15:2140
Young, A.L., A new initiative on radiation coordination in the federal government, 15:2556 (BA;US)
Young, C.E., Velocity distribution of laser photoionized neutrals ejected from methanol-dosed aluminium(111) by electron-stimulated desorption, 15:4209 (R;US)
Young, C.F., *See* Reeme, T.L., 15:2592
Young, D.E., *See* Lennox, A.J., 15:3619
Young, J.M., *See* Bradshaw, W.M., 15:2075
Young, N.A., *See* Bowsher, B.R., 15:3069
See Ogden, J.S., 15:3068
Young, P.G., *See* Chadwick, M.B., 15:4429
Younger, S.M., *See* Muller, A., 15:3917
Yow, J.L. Jr., *See* Ubbes, W.F., 15:2237
Yu, C., Demonstration of a computer model for residual radioactive material guidelines, RESRAD, 15:2183 (R;US)
Yu, P.L., Studies of high power density, pico-second rise-time light-activated semiconductor switch. Final report, 1 September 1987-31 December 1988, 15:3223 (R;US)
Yu, P.Y., *See* Shan, W., 15:3033
Yu, S.S., *See* Chen, P., 15:3277
See Shay, H.D., 15:3167
Yuan, C., *See* Kane, G.L., 15:4012
Yuan, Y.C., *See* Yu, C., 15:2183
Yun, W., *See* Bloch, J.M., 15:3030
Yurchenko, N.I., *See* Berdov, B.A., 15:3636
Yusa, Y., *See* Arai, T., 15:3804
See Miyahara, K., 15:2224
Yusa, Yasuhisa, *See* Idemitsu, Kazuya, 15:2223

Z

Zaebst, D., *See* Montopoli, M., 15:3457
Zagrodnik, J.P., Development of advanced battery systems for vehicle applications, 15:2587 (B;US)
Zahed, I., *See* Hansson, T.H., 15:3998
Zahn, M.T., Distribution of heavy metals and anions in the groundwater of quaternary gravel deposits in the Munich area (Dornach). Laboratory and field test results, 15:3540 (R;DE;In German)
Zaider, M., *See* Hall, E.J., 15:3694
Zajtsev, V.I., *See* Borejsho, D.E., 15:3634

Zandbergen, H.W., High resolution electron microscopic study of the growth of denser phases on zeolite Y and zeolite L, 15:2935 (BA;US)
Zangvil, A., *See* Shi, D., 15:2947
Zank, G.P., Nonlinear waves in cosmic ray magnetohydrodynamics, 15:3825 (RA;DE;In German)
See Voelk, H.J., 15:3824
Zank, L.A., *See* Voelk, H.J., 15:3824
Zapotosky, J.E., *See* Haradem, D.P., 15:3795
Zarnstorff, M.C., *See* Park, H.K., 15:4350
Zasadzinski, J.F., Tunneling spectroscopy and the electron-phonon interaction in $Ba_{1-x}K_xBiO_3$, 15:4254 (R;US)
Zeh, C.M., *See* Minkov, V., 15:2758
Zeldman, B., *See* Segel, R.E., 15:4081
Zell, I., Free radicals in irradiated oriented DNA fibers: Results from B-form DNA and from deuterated DNA samples, 15:3734 (RA;DE)
Zeman, G.H., *See* Bogo, V., 15:3691
Zeppenfeld, P., *See* Hall, B., 15:2888
Zeuner, G., Documentation of the first measuring campaign of September 8-12, 1986 within the framework of the research project 'Dispersion of pollutants in complex terrain after short-term emissions', 15:3392 (R;DE;In German)
Zevrieva, I.F., *See* Zholkiver, K.I., 15:3660
Zey, J.N., Health-hazard evaluation report HETA 87-109-1950, North Riverside Fire Department, North Riverside, Illinois, 15:3458 (R;US)
Zhakov, I.G., Results of combined treatment of patients with pulmonary carcinoma using artificial hyperglycemia, 15:3667 (RA;SU;In Russian)
Zhang Jingzhong., Induction on a continuous variable, 15:4269 (R;XA)
Zhang, C.H., *See* Perera, R.C.C., 15:3019
Zhang, Hong Lin, Relativistic cross sections for excitation of highly charged ions to specific magnetic sublevels by an electron beam, 15:3896 (R;US)
Relativistic distorted wave collision strengths and oscillator strengths for the 85 Li-like ions with $8 \leq Z \leq 92$, 15:3897 (R;US)
Zhang, J.-Y., Global trends and structural consequences of the proton-neutron interaction, 15:4125 (R;US)
Zhang, K., Solubility and superconductivity in $RE(Ba_{2-x}RE_x)Cu_3O_{7+\delta}$ (RE = Nd, Sm, Eu, Gd, Dy), 15:4250 (R;US)
Zhang, Z., *See* Shechter, H., 15:2881
Zhao Zong-ci, *See* Schlesinger, M.E., 15:3471
Zhao, G., Electronic origin of the intermediate phase of NiTi, 15:2892 (J;US)
Zhao, J., *See* Blakers, A.W., 15:2318
Zhao, Q., *See* Buschert, J.R., 15:3017
Zhao, X., Dissociation of cyclohexene and 1,4-cyclohexadiene in a molecular beam, 15:3098 (J;US)
Zharkov, V.V. and others, *See* Zhakov, I.G., 15:3667
Zhavrid, Eh.A., *See* Zhakov, I.G., 15:3667
Zheng, Y., *See* Schlesinger, Z., 15:2958
Zhidkov, E.P., Iterative methods of domain decomposition with cross-points for the solution of discrete elliptic problems, 15:4518 (R;SU)
Zholkiver, K.I., Methods of prophylaxis of local radiation injuries based on use of radiobiological models, 15:3660 (RA;SU;In Russian)
Zhou Huilan, Thermal stress and seismogenesis, 15:3809 (R;XA)
Zhou Huilan., Self-similar growth of three-dimensional fault, 15:3810 (R;XA)
Zhu, Yu Sheng, Transcription of oxygen-regulated photosynthetic genes requires DNA gyrase in Rhodobacter capsulatus, 15:3606 (J;US)
Zieher, K.W., *See* Grothaus, M.G., 15:4365
Zielen, A.J., *See* Yu, C., 15:2183
Zierler, S., Case-control study of bladder cancer in Massachusetts among populations receiving chlorinated and chloraminated drinking water, 15:3771 (R;US)
Ziesche, P., Interface stress theorem and Hellmann-Feynman relations for Bijellic systems, 15:4220 (R;XA)
Zietlow, T.C., *See* Krantz, R.J., 15:3222
Zimina, E.S., *See* Kiseleva, E.S., 15:3644
Zinke-Allmang, M., *See* Behar, M., 15:4227
Zinn, B.T., *See* Gal-Ed, R., 15:2152
Zocco, T.G., *See* Jervis, T.R., 15:2866
Zoeller, L., *See* Sauer, W., 15:3060
Zohar, Y., *See* Ho, C. M., 15:3204
Zscheeg, H., *See* Kissel, J., 15:3348
Zucchiatti, A., *See* Viesti, G., 15:4091
Zucchini, R., *See* Ordonez, C.R., 15:4009
Zukerman-Schpector, J., Analysis by X-ray diffraction of new esquiatosomicides, 15:4222 (R;BR;In Portuguese)
Zushi, H., Density clamping phenomena in electron cyclotron resonance heated plasmas on Heliotron E, 15:4344 (R;JP)
Zushi, Hideki, *See* Kondo, Katsumi, 15:4345
Zvekotkina, L.S., *See* Bojko, A.V., 15:3638
Zwahlen, E.D., Gas flow in and out of a nuclear waste container, 15:2211 (R;US)
Zweben, S.J., Visible imaging of edge fluctuations in the TFTR tokamak, 15:4383 (J;US)
Zweibel, K., *See* Ullal, H.S., 15:2308
Zwi, H., *See* Kuthi, A., 15:4382
Zwickler, S., *See* Baumann, W., 15:3293, 15:3294, 15:3345, 15:3889, 15:3890
Zygelman, B., Radiative and nonradiative charge transfer in He^++H collisions at low energy, 15:3913 (J;US)

Subject Index

This index is arranged by subject descriptors selected from those assigned to each citation in this publication. Subject descriptors are selected from a controlled thesaurus of terms, *EDB Subject Thesaurus* (DOE/OSTI-7000). In order to enhance indexing, subject descriptor entries generally consist of a pair of descriptors: a main term and a qualifier term. Each entry includes the full title (which may be followed by supplementary descriptive information in parentheses) and the citation number. Additional information given in parentheses indicates the document type (an abbreviation such as B for book), the country of publication (such as DE for Federal Republic of Germany), and the language if non-English.

See references guide users from synonymous terms to the descriptors selected for the concept. *See also* references indicate subject concepts that are more specific than a particular descriptor. To gain complete subject coverage, all such terms should be reviewed.

A

A CODES
Short-time-scale measurements of fenestration thermal performance under realistic springtime conditions, 15:2343 (BA;US)

A0-980 MESONS
Composite scalar mesons in QCD, 15:3988 (R;XA)

ABANDONED SHAFTS
Use of foaming mud cement to terminate underground coal fires and to control subsidence of burn cavities. Final report, 15:2091 (R;US)

ABANDONED SITES
Demonstration of a computer model for residual radioactive material guidelines, RESRAD, 15:2183 (R;US)
Phase 1 spring and seep report: Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri: Revision 0, 15:2242 (R;US)
Results of the independent verification of radiological remedial action at 196 East 3rd South Street, Monticello, Utah (MS00083), 15:3513 (R;US)
Results of the independent verification of radiological remedial action at 381 East 3rd South Street, Monticello, Utah (MS00140), 15:3511 (R;US)
Results of the independent verification of radiological remedial action at 384 South 2nd East Street, Monticello, Utah (MS00084), 15:3514 (R;US)
Results of the independent verification of radiological remedial action at 98 East 5th South Street, Monticello, Utah (MS00076), 15:3512 (R;US)
Results of the radiological survey at 133 Maywood Avenue, Maywood, New Jersey (MJ025), 15:3510 (R;US)
Results of the radiological survey at 72 Sidney Stret, Lodi, New Jersey (LJ067), 15:3509 (R;US)
Results of the radiological survey at 9 Hancock Street, Lodi, New Jersey (LJ028), 15:3508 (R;US)

ABIES
See FIRS

ABNORMALITIES (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS

ABSORBED DOSES
See RADIATION DOSES

ABSORBERS (SOLAR)
See SOLAR ABSORBERS

ABSORPTION (INTESTINAL)
See INTESTINAL ABSORPTION

ABSORPTION SPECTROSCOPY
Two-dimensional spectroscopy: Theory of nonstationary, time-dependent absorption and its application to femtosecond processes, 15:3099 (J;US)

ACCELERATOR FACILITIES
See also STANFORD LINEAR COLLIDER
TARGET CHAMBERS
Challenges for utilization of the new synchrotron facilities, 15:3266 (R;US)

ACCELERATORS
See also HEAVY ION ACCELERATORS
LINEAR ACCELERATORS
PARTICLE BEAM FUSION ACCELERATOR
RAILGUN ACCELERATORS
WAKEFIELD ACCELERATORS
Accelerator and Fusion Research Division: 1988 summary of activities, 15:3259 (R;US)
Heat transfer, 15:2805 (B;US)
The evolution of high energy accelerators, 15:3258 (R;US)

ACCIDENTAL INTAKE
See ACCIDENTS

ACCIDENTAL IRRADIATION
See RADIATION ACCIDENTS

ACCIDENTS
See also RADIATION ACCIDENTS
REACTOR ACCIDENTS
Hints and search strategies for the substances listed in the Accident Ordinance, 15:3803 (R;DE;In German)

ACCUMULATION (RADIOECOLOGICAL)
See RADIOECOLOGICAL CONCENTRATION

ACES
See QUARKS

ACETONITRILE
The bonding of acetonitrile and CH_2CN on Ag(110) determined by near edge x-ray absorption fine structure: Evidence for π-donor bonding and azimuthal ordering, 15:3090 (J;US)

ACETYLENE
High resolution spectroscopic detection of acetylene–vinylidene isomerization by spectral cross correlation, 15:3084 (J;US)
Laser photoelectron spectroscopy of ions: Progress report, 1988–1989, 15:3095 (R;US)

ACID RAIN
A collaborative effort to model plant response to acidic rain, 15:3404 (R;US)
A process for the preparation of cysteine from cystine, 15:2076 (P;US)
Characterization of year-round sensitivity of California's Montane Lakes to acidic deposition. Final report, October 1986-June 1989, 15:3552 (R;US)
Development of an inventory of materials potentially sensitive to ambient atmospheric acidity in the South Coast Air Basin. Final report, 15:3558 (R;US)
Development of the advanced utility simulation model. Report for May 1985-September 1988, 15:2430 (R;US)
Effects of acid deposition on painted wood substrates, 15:3432 (R;US)
Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Southern Blue Ridge Province data base, 15:3553 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Northeast data base, 15:3555 (R;US)

Physical characteristics of study plots. Across-a-Lake States acidic-deposition gradient. Forest Service resource bulletin, 15:3455 (R;US)
Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989, 15:3460 (R;US)
Red spruce decline—Winter injury and air pollutants, 15:3427 (R;US)
US and Canadian emissions inventory, 1985. Report for March-September 1988, 15:3442 (R;US)
Water resources data for Wisconsin, Water Year 1988. Water-data report (Annual), 1 October 1987-30 September 1988, 15:3559 (R;US)
[Deposition of atmospheric nitrogen species to forests in North America and Europe]: Foreign trip report, September 24–October 11, 1989, 15:3422 (R;US)
[Discussions of global environmental problems]: Foreign trip report, October 14, 1989–October 21, 1989, 15:3426 (R;US)
[Growth and physiology of red spruce in relationship to acidic deposition in the Great Smoky Mountains National Park, USA]: Foreign trip report, September 30, 1989–October 14, 1989, 15:3423 (R;US)

ACIDIFICATION
Effects of acid and lime on mesofauna of forest soils in the laboratory and in the field. Final report, 15:3762 (R;DE;In German)

ACOUSTICS
Acoustic studies of new materials: Quasi crystals, low-loss glasses, and high tc superconductors. Annual summary report, 1 October 1988-30 September 1989, 15:2901 (R;US)

ACQUIRED IMMUNODEFICIENCY SYNDROME
See AIDS

ACRYLIC POLYMERS
See POLYACRYLATES

ACRYLONITRILE
Best demonstrated available technology (BDAT) background document for K011, K013, and K014. Final report, 15:2769 (R;US)

ACTINIDE BURNER REACTORS
Thermal-hydraulics of actinide burner reactors. Conceptual study of actinide burner reactors, (3), 15:2471 (R;JP;In Japanese)

ACTINIDE NUCLEI
See also EINSTEINIUM 254
PLUTONIUM 239
THORIUM 220
THORIUM 222
THORIUM 228
THORIUM 230
THORIUM 232
URANIUM 234
URANIUM 235
URANIUM 236
URANIUM 238
Translation of selected papers published in Nuclear Constants 4, 1986, 15:4112 (R;XA)

ACTINIUM X
See RADIUM 223

ACTIVATION ANALYSIS
Activities of the neutron activation analysis laboratory of the radiochemistry division of IPEN - CNEN/SP, 15:4494 (R;BR;In Portuguese)

ADA
Rationale for the proposed standard for a generic package of elementary functions for Ada: Revision 1, 15:4504 (R;US)
Research, development, training, and education using the Ada programming language. Final report, 1 September 1987-31 May 1989, 15:4503 (R;US)

ADENINES
Radiation chemistry of adenine derivatives following direct ionization in solids: ESR and ENDOR investigations, 15:3716 (RA;DE)

ADENOCARCINOMAS
See CARCINOMAS

ADENOSINE TRIPHOSPHATASE
See ATP-ASE

ADENOSINE TRIPHOSPHATE
See ATP

ADSORBENTS
Calcination of calcium hydroxide sorbent in the presence of SO_2 and its effect on reactivity. Report for October 1988-March 1989, 15:3443 (R;US)

ADVANCED TEST IDAHO REACTOR
See ATR REACTOR

AERODYNAMICS
Actuator disc edge singularity. The key to a revised actuator disc concept and momentum theory, 15:2367 (RA;DK)
Joint action on aerodynamics of wind turbines, 15:2365 (R;DK)

AEROSOLS
See also SMOKES
Beryllium dispersion near explosive firing tables: A comparison of computed and observed results, 15:3468 (R;US)
Estimation of aerosol absorption from measurements of intensity and polarization of the sky radiation at Tsumeb (Namibia). Final report, 15:2291 (R;DE;In German)
In situ optical measurements of hydrofluoric acid aerosols, 15:3469 (R;US)
Pathophysiological and disease constraints on aerosol delivery, 15:3767 (R;US)
Regional aerosol deposition in human upper airways: Annual progress report, March 1, 1989–February 28, 1990, 15:3414 (R;US)
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)
Vertical distribution of pollutants in the presence of convective storms, 15:3406 (R;US)

AFTERGLOW
Experimental study of microwave transmission through a decaying plasma. Final report, January 1986-February 1988, 15:3936 (R;US)

AFTERLOADING
Dependence of local radiation complications on methods of intracavitary gamma-therapy in concomitant radiotherapy of stage 1 cervix uteri carcinoma, 15:3741 (RA;SU;In Russian)

AGGLUTINATION
See ANTIGEN-ANTIBODY REACTIONS

AGRICULTURAL RESIDUES
See AGRICULTURAL WASTES

AGRICULTURAL WASTES
Incineration studies. October 1985-September 1989 (Citations from the COMPENDEX data base). Report for October 1985-September 1989, 15:2778 (R;US)

AHUACHAPAN GEOTHERMAL FIELD
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 1, Text and main figures, 15:2355 (R;US)
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 2, Appendices A through E, 15:2356 (R;US)

AIDS
Los Alamos Science: AIDS research, 15:3676 (R;US)

AIR
Enhanced flame stability and soot radiation using electric fields. Final report, July 1986-January 1989, 15:3114 (R;US)
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)
Participation in the MAP3S precipitation chemistry network: Progress report, August 1, 1988–July 31, 1989, 15:3410 (R;US)

AIR CONDITIONERS
Conventional research house: Cooling characterization test results. Topical report, June-September 1987, 15:2697 (R;US)
Development of high-efficiency scroll compressors for air conditioners, 15:2695 (R;JP)
Mobile air-conditioner refrigerant evaluation. Report for April 1988-March 1989, 15:3441 (R;US)

AIR FILTERS
Method for measuring the effectiveness of gaseous-contaminant removal filters, 15:3257 (R;US)

AIR FLOW
Experimental investigations of the rotor loads and the rotor-induced flow of a two-bladed wind turbine model in the low speed wind tunnel of DLR, 15:2378 (RA;DK)

AIR POLLUTION
See also INDOOR AIR POLLUTION
Ozone depletion, greenhouse gases, and climate change, 15:3429 (R;US)

Bioassay
Use of bioassay methods to evaluate incinerator emissions, 15:3440 (R;US)

Biological Effects
Carbohydrate translocation and branch autonomy of Pinus ponderosa, 15:2309 (R;US)
Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)
Effects of air pollutants on photosynthesis, vegetative growth, and development of grapevines in the San Joaquin Valley of California. Final report, February 1987-February 1989, 15:3445 (R;US)
Human-health studies of carbon monoxide (CO) under conditions of military weapons systems crewman exposures. Protocol 1: Formation of cohb. Final report, September 1982-March 1985, 15:3755 (R;US)
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)

Carcinogens
Complex mixtures of urban air pollutants: Identification and comparative assessment of mutagenic and tumorigenic chemicals and emission sources, 15:3784 (R;US)

Comparative Evaluations
Comparison of 0600-0900 AM hydrocarbon compositions obtained from 29 cities, 15:3431 (R;US)

Computer Codes
Programmer's guide to MOBILE4 (mobile source emission factor model). Technical report, 15:2797 (R;US)

Computerized Control Systems
FACE: A free-air facility for fumigation with gaseous air pollutants: Revision, 15:3405 (R;US)

Environmental Effects
5th status colloquium of the PEF, March 7-9, 1989 in the Nuclear Research Center in Karlsruhe. Summarizing reviews of the program management, 15:3416 (R;DE;In German)

Forests
5th status colloquium of the PEF, March 7-9, 1989 in the Nuclear Research Center in Karlsruhe. Summarizing reviews of the program management, 15:3416 (R;DE;In German)

Long-Range Transport
Calculation of air pollution dispersion over a complex terrain with special emphasis on dimensioning of chimney stacks, 15:3420 (R;DK;In Danish)

Mathematical Models
Are ozone exceedance rates decreasing? Comment on extreme value analysis of environmental time-series: An application to trend detection in ground-level ozone. Technical report, 1 January-31 July 1989, 15:3401 (R;US)
Integration of fluid modeling with complex-terrain field studies and model-development efforts, 15:3449 (R;US)

Mutagens
Complex mixtures of urban air pollutants: Identification and comparative assessment of mutagenic and tumorigenic chemicals and emission sources, 15:3784 (R;US)

Occupational Diseases
Asbestos and silicate pollution in the work place. January 1978-July 1989 (Citations from Pollution Abstracts). Report for January 1978-July 1989, 15:3461 (R;US)

Pollution Control Equipment
Quantitative evaluation of air-filtration systems in use at asbestos abatement sites: Research in progress, 15:3256 (R;US)

Public Health
Information on substances for review as toxic air contaminants. Summary report, January 1984-February 1989 (Final), 15:3430 (R;US)

Regional Analysis
Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989, 15:3460 (R;US)

AIR POLLUTION ABATEMENT
Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988, 15:2418 (R;US)
Method for measuring the effectiveness of gaseous-contaminant removal filters, 15:3257 (R;US)
National report for the Netherlands. The IEA energy technology systems analysis project (ETSAP)/Annex 3, 15:3470 (B;NL)
New chemical alternatives to chlorofluorocarbons and halons. Report for August 1988-February 1989, 15:3436 (R;US)

AIR POLLUTION CONTROL
Air toxics control situation room. Report for July 1988-March 1989, 15:3450 (R;US)
BACT/LAER (Best Available Control Technology/Lowest Achievable Emission Rate) Clearinghouse: A compilation of control-technology determinations. Fourth supplement to 1985 edition. Summary tables and appendices A-H, 15:3491 (R;US)
Calcination of calcium hydroxide sorbent in the presence of SO_2 and its effect on reactivity. Report for October 1988-March 1989, 15:3443 (R;US)
Compliance testing of the Eglin AFB (Air Force Base) asphalt-concrete Batch Plant, Eglin AFB, Florida. Final report, 5-11 March 1989, 15:3403 (R;US)
Destruction of volatile organic compounds using catalytic oxidation. Report for April 1987-December 1988, 15:3439 (R;US)
Electrostatic precipitation of charged particles from a turbulent flow between coaxial cylinders, 15:3402 (R;US)
Incinerability index: A measure of incinerator performance, 15:2743 (R;US)
Recent developments of emission control technology in the United States for fossil fuel combustion sources, 15:3249 (R;US)
Source characterization and control technology assessment of methylene chloride emissions from Eastman Kodak Company, Rochester, NY. Final report, July 1988-April 1989, 15:3452 (R;US)

AIR POLLUTION MONITORING
Semiconductor gas sensors. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989, 15:3370 (R;US)

AIR POLLUTION MONITORS
Experiences of DOAS technique for flue gas measurements, 15:3467 (R;SE;In Swedish)

AIR QUALITY
Air quality monitoring at toxic waste sites: A Hanford perspective, 15:3464 (R;US)
Contribution to atmospheric pollution of the activities of CSI Italsider in Bagnoli, 15:3415 (TG;US)
Indoor air quality: Selected references, 15:3448 (R;US)
Sensitivity of a regional oxidant model to variations in climate parameters. Volume 1 and 2. Final report, 15:3453 (R;US)

AIR SAMPLERS
Measurement of condensable vapor contribution to PM10 emissions, 15:2696 (R;US)
Pilot investigation of indoor-outdoor and personal PM10 (thoracic) and associated ionic compounds and mutagenic activity. Final report, February 1987-April 1989, 15:3447 (R;US)
Use of micrometeorological parameters in the establishment of a VOC (volatile organic compounds) monitoring network. Technical report (Final), 15:3454 (R;US)

AIR-FUEL RATIO
See FUEL-AIR RATIO

AIR-WATER INTERACTIONS
Water treatment: Air stripping. December 1981-July 1989 (Citations from the Selected Water Resources Abstracts data base). Report for December 1981-July 1989, 15:3562 (R;US)

AIRBORNE PARTICLES
See PARTICULATES

AIRBORNE PARTICULATES
See PARTICULATES

AIRCRAFT
Engineering Assignment 5, E-4B surveillance methodology. Final report, 15:3386 (R;US)

Model for measuring complex performance in an aviation environment, 15:3127 (R;US)
AIRCRAFT ACCIDENTS
See ACCIDENTS
AIRCRAFT COMPONENTS
Compatibility of fuel-system components with high density fuel. Final report, April 1987-January 1989, 15:2781 (R;US)
AIRCRAFT FUELS
See AVIATION FUELS
AIRFOILS
High temperature constitutive and crack initiation modeling of coated single crystal superalloys, 15:2845 (RA;US)
Measurement of airfoil heat transfer coefficients on a turbine stage, 15:3199 (RA;US)
Turbine airfoil film cooling, 15:3202 (RA;US)
AIRGLOW
Optical instrumentation support for the airborne ionospheric observatory. Report for 1 July 1987-30 June 1988, 15:3884 (R;US)
ALARA
Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report, 15:2195 (R;US)
ALARM DOSEMETERS
See RADIATION MONITORS
ALARM SYSTEMS
Applying AI techniques to improve alarm display effectiveness, 15:2247 (BA;US)
ALASKA
Specifying monthly mean surface temperatures in Canada and Alaska from the 500 mb height field, 15:3398 (J;US)
ALBERTA
Alberta/Canada Energy Resources Fund annual review, 1987-88, 15:2603 (R;CA;In English and French)
ALCATOR DEVICE
Applications of free-electron laser technology to magnetic fusion, 15:4481 (J;US)
ALDEHYDES
See also FORMALDEHYDE
Selection of an effective biocide and toxicity evaluation for a specific MEOR [microbial enhanced oil recovery] microbial formulation, 15:2114 (R;US)
ALDEHYDO ACIDS
See ALDEHYDES
ALFVEN WAVES
On the quantum inverse problem for a new type of nonlinear Schroedinger equation for Alfven waves in plasma, 15:4314 (R;XA)
ALGEBRA
Note on p-semisimple BCI-algebras, 15:4275 (R;XA)
On prime ideals and associated spectrum of BCK-algebras, 15:4280 (R;XA)
ALGINIC ACID
The biocorrosion of copper by biopolymers as examined in situ, in real time FT-IR/CIR/ATR in conjunction with pre and post XPS/AES, 15:2832 (R;US)
ALKALI METAL COMPOUNDS
See also LITHIUM COMPOUNDS
POTASSIUM COMPOUNDS
SODIUM COMPOUNDS
Local coordination of polyvalent metal ions in molten halide mixtures, 15:4218 (R;XA)
Production of coke with specific metallurgical properties. Analysis of conditions in the blast furnace, 15:2029 (R;DE;In German)
ALKALI METALS
See also LITHIUM
POTASSIUM
SODIUM
Interface stress theorem and Hellmann-Feynman relations for Bijellic systems, 15:4220 (R;XA)
ALKANES
See also BUTANE
METHANE
Transition metal catalyzed transformations of unsaturated molecules, 15:3074 (R;US)
ALKENES
See also CYCLOALKENES
ETHYLENE
Key chemicals from synthesis gas - development of novel zeolites as catalysts for conversion of methanol into hydrocarbons, 15:2028 (R;DE;In German)
Transition metal catalyzed transformations of unsaturated molecules, 15:3074 (R;US)
ALLOY SYSTEMS
See also BINARY ALLOY SYSTEMS
Estimation of thermodynamic properties of alloys from phase diagram and other loose boundary conditions, 15:2838 (R;JP;In Japanese)
ALLOY-1915
See ALUMINIUM BASE ALLOYS
ALLOY-214X
See ALUMINIUM BASE ALLOYS
ALLOY-50KH4N6G12F2V
See CHROMIUM ALLOYS
ALLOY-60T
See TITANIUM BASE ALLOYS
ALLOY-79NM
See NICKEL BASE ALLOYS
ALLOY-FE46NI33CR21
Stress corrosion cracking of nickel base alloys characterization and prediction, 15:2813 (R;FR)
ALLOY-GE
See COPPER ALLOYS
ALLOY-GMR-235
See NICKEL BASE ALLOYS
ALLOY-HD-8077
See NICKEL BASE ALLOYS
ALLOY-KH20N80T
See NICKEL BASE ALLOYS
ALLOY-KHN77TYU
See NICKEL BASE ALLOYS
ALLOY-M-252
See NICKEL BASE ALLOYS
ALLOY-MA-754
See NICKEL BASE ALLOYS
ALLOY-MA-956
See IRON BASE ALLOYS
ALLOY-MM-0011
See NICKEL BASE ALLOYS
ALLOY-NI59CR30FE9
Stress corrosion cracking of nickel base alloys characterization and prediction, 15:2813 (R;FR)
ALLOY-NI76CR15FE8
Stress corrosion cracking of nickel base alloys characterization and prediction, 15:2813 (R;FR)
ALLOY-VTZ-1
See TITANIUM BASE ALLOYS
ALLOY-WAZ-16
See NICKEL BASE ALLOYS
ALLOYS
See also ALUMINIUM ALLOYS
CARBON ADDITIONS
CESIUM ALLOYS
CHROMIUM ALLOYS
COPPER ALLOYS
CORROSION RESISTANT ALLOYS
GERMANIUM ALLOYS
GOLD ALLOYS
HEAT RESISTING ALLOYS
IRON ALLOYS
LEAD ALLOYS
MANGANESE ALLOYS
MOLYBDENUM ALLOYS
NICKEL ALLOYS
NIOBIUM ALLOYS
POTASSIUM ALLOYS
RHENIUM ALLOYS
RUBIDIUM ALLOYS
SILICON ALLOYS

SODIUM ALLOYS
TANTALUM ALLOYS
TELLURIUM ALLOYS
TITANIUM ALLOYS
TUNGSTEN ALLOYS
VANADIUM ALLOYS
ZIRCONIUM ALLOYS
Corrosion database for the nuclear fuel cycle. Sub-project no. 1. Final report, 15:4544 (R;DE;In German)
Phase selection in undercooled liquids of pulsed-laser melted alloys, 15:2865 (BA;US)

ALPHA REACTIONS
α-scattering on ^{100}Mo, 15:4092 (RA;DE;In German)
Results of the α-scattering on the even, stable Ge isotopes, 15:4090 (RA;DE;In German)
Thick-target ^{21}Ne yield of the reaction $^{18}O(\alpha,n)^{21}Ne$ in the range 4.0-8.8 MeV, 15:4078 (RA;DE;In German)

ALPHA-BEARING WASTES
3D thermal stress analysis of WIPP [Waste Isolation Pilot Plant] Room T RH TRU [Remote Handled Transuranic] experiments, 15:2235 (R;US)
Nondestructive assay and nondestructive examination of remote-handled transuranic waste at the ORNL waste handling and packaging plant, 15:2181 (R;US)
Quality assurance guidance for TRUPACT-II [Transuranic Package Transporter-II] payload control, 15:2189 (R;US)
Training waste generators: The first responder in proper waste management, 15:2184 (R;US)

ALUMINIA
See ALUMINIUM OXIDES

ALUMINIUM
Flux degassing of aluminium swarf and dross. A demonstration [at Birmal Components Ltd (Warley), Sarginson Bros Ltd (Coventry) and Cookson Precision Castings Ltd (London)], 15:2726 (R;GB)
Hydrogen and helium in metals: positron lifetime experiments. Quarterly report 3. quarter 1987, 15:2839 (R;FI)
Low temperature diffusivity for aluminum and silver in amorphous silicon, 15:2310 (BA;US)
Nuclear spin relaxation of ^{12}B implanted in various metallic single crystals, 15:4228 (RA;DE;In German)
Steel initiative: Development of superplastic steel processing: First annual progress report, March 15, 1988–March 15, 1989, 15:2827 (R;US)
Strain induced amorphization of aluminium by manganese implantation, 15:4215 (R;XA)
Velocity distribution of laser photoionized neutrals ejected from methanol-dosed aluminium(111) by electron-stimulated desorption, 15:4209 (R;US)

ALUMINIUM 27 TARGET
Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures, 15:4082 (J;NL)
Shapes of ^{59}Cu nuclei at moderate excitation energies and spin, 15:4091 (J;US)

ALUMINIUM ALLOYS
See also ALUMINIUM BASE ALLOYS
Effect of chromium on properties of Fe_3Al, 15:2874 (J;US)
Elastic instability during amorphization of intermetallic compounds by charged-particle beams, 15:2861 (BA;US)
Evaluation and thermodynamic analysis of phase equilibria in the U-Al system, 15:2869 (J;NL)
Exploratory study of niobium, titanium, zirconium, and tantalum aluminides. Final report, 1 March 1988-31 May 1989, 15:2807 (R;US)
Fatigue characterization of a VAWT blade material, 15:2396 (BA;US)
Fundamentals of beam-solid interactions and transient thermal processing, 15:2857 (B;US)
Hydrogen effects in aluminum, 15:2870 (J;IL)
Influence of microstructure and microdamage processes on fracture at high loading rates. Final report, 1 February 1986-30 September 1988, 15:2806 (R;US)
Kinetic paths of B2 and DO_3 order parameters: Experiment, 15:2872 (J;US)
Patterson analysis of aperiodic crystals, 15:2894 (J;US)
Pretreatment and conditioning of storage ring vacuum systems, 15:3315 (R;US)
Status of high-density fuel plates fabrication: Final draft, 15:2164 (R;US)

ALUMINIUM ARSENIDES
Electric field response of a semiconductor superlattice optical mirror from electroreflectance spectra, 15:3008 (J;US)
Magnetic studies of persistent photoconductivity in *n*-$Al_xGa_{1-x}As$, 15:3010 (J;US)
Pressure dependence of the *DX* center in $Ga_{1-x}Al_xAs$:Te, 15:3033 (J;US)
Semiconductor quantum-well lasers and related optoelectronic devices on silicon, III-V. Technical report, 15:3145 (R;US)

ALUMINIUM BASE ALLOYS
Chemical cleaning of aluminum alloy surfaces for use as vacuum materials in synchrotron light sources, 15:2818 (R;US)
Effects of precipitate distribution on 293 K and 77 K properties of 2090-T81 weldments, 15:2840 (R;US)
Fracture toughness of SiC/Al metal matrix composite, 15:2973 (R;US)

ALUMINIUM BROMIDES
Dissociation energy of the molecule AlBr from equilibrium measurements, 15:3092 (J;US)

ALUMINIUM NITRIDES
Sialon ceramics. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989, 15:2933 (R;US)

ALUMINIUM OXIDES
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 2, 15:2262 (R;US)
Comprehensive characterization studies of sulfided molybdenum catalysts: Final progress report, 15:2828 (R;US)
Continuous high-temperature lubrication of ceramics by carbon generated catalytically, 15:2900 (R;US)
High-temperature corrosion of heat exchanger materials, 15:2911 (R;US)
Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)
Single layer $Al_2O_3 \cdot H_2O$ and multilayer $Al_2O_3 \cdot H_2O$–SiO_2 optical coatings prepared from colloidal suspensions, 15:3020 (J;US)
Structure and insulator material choices for the TITAN reversed-field-pinch reactor study, 15:4470 (BA;US)
Structure of amorphous Al_2O_3 produced by ion implantation, 15:2908 (R;US)
Synthesis of oxide powders by plasma vaporization of solutions, 15:2938 (BA;US)
The effects of annealing on the structure and distribution of charge states of iron implanted into α-Al_2O_3 at 77 K, 15:2907 (R;US)

ALUMINUM
See ALUMINIUM

ALVEOLI (PULMONARY)
See LUNGS

AMBIPLASMA
High density matter state equation and phase transitions, 15:4003 (R;FR;In French)

AMERICIUM
Search for a fission fragment anisotropy signal after optical spin exchange pumping on ^{242m}Am, 15:4117 (RA;DE;In German)

AMERICIUM ISOTOPES
Delayed-fission properties of neutron-deficient americium nuclei, 15:4120 (R;US)

AMES TEST
See MUTAGEN SCREENING

AMIDES
Laser photoelectron spectroscopy of ions: Progress report, 1988–1989, 15:3095 (R;US)

AMINO ACIDS
See also CYSTEINE
Gamma-radiation affects active electrolyte transport by rabbit ileum. 2. Correlation of alanine and theophylline response with morphology, 15:3689 (R;US)

AMINOHYPOXANTHINE
See GUANINE
AMINOTOLUENES
See TOLUIDINES
AMMONIA
Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)
Effects of coal-derived trace species on the performance of molten carbonate fuel cells: Topical report (Progress report No. 4), 15:2657 (R;US)
Stable isotope studies: Progress report, October 1988–October 1989, 15:3075 (R;US)
The influence of adsorbate–absorbate hydrogen bonding in molecular chemisorption: NH_3, HF, and H_2O on Au(111), 15:3094 (J;US)
AMMONIUM SULFATES
Characterization and modification of particulate properties to enhance filtration performance: Quarterly technical progress report, December 1988–February 1989, 15:2423 (R;US)
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)
AMORPHOUS STATE
Statistical mechanical models for liquid and amorphous structure in covalently bonded systems, 15:4217 (R;XA)
AMPLIFIERS
Broadband cryogenic preamplifiers incorporating GaAs MESFETs for use with low-temperature particle detectors, 15:3232 (J;US)
ANADROMOUS FISHES
See also SALMON
State of Idaho augmented anadromous fish health monitoring: Annual report, FY 1988, 15:2281 (R;US)
ANALOG RESONANCES
See RESONANCE
ANALYSIS (ACTIVATION)
See ACTIVATION ANALYSIS
ANALYSIS (GAS)
See GAS ANALYSIS
ANALYSIS (QUANTITATIVE CHEMICAL)
See QUANTITATIVE CHEMICAL ANALYSIS
ANALYSIS (THERMAL)
See THERMAL ANALYSIS
ANEMOMETERS
Advances in three-dimensional turbulence measurement capability, 15:2388 (BA;US)
Gas velocity measurements in purged port posting systems, 15:3124 (R;GB)
ANGIOGRAPHY
See BIOMEDICAL RADIOGRAPHY
ANGRA-1 REACTOR
Computer-aided event tree analysis by the impact vector method, 15:2475 (R;BR;In Portuguese)
Considerations about the uncertainty propagation in the probabilistic safety analysis, 15:2446 (R;BR;In Portuguese)
Determination of the protection set-points lines for the Angra-1 reactor core, 15:2441 (R;BR;In Portuguese)
Event tree for the Angra 1 big LOCA, 15:2447 (R;BR;In Portuguese)
Reliability study of low pressure recirculation system of Angra 1, 15:2448 (R;BR;In Portuguese)
Study of Angra I reactor core with inserted control rods, 15:3991 (R;BR;In Portuguese)
ANIMAL CELLS
See also CHO CELLS
TUMOR CELLS
Radiation damage and its influence on source requirements for high resolution x-ray holography, 15:3680 (R;US)
ANIMAL FEEDS
Water hyacinth horticulture management of manure, 15:2735 (R;DK;In Danish)
ANIMAL TISSUES
See also BONE MARROW
Handbook of selected tissue doses for projections common in diagnostic radiology, 15:3679 (R;US)
ANIMALS
See also INVERTEBRATES
A review of the literature on the toxicity of rare-earth metals as it pertains to the Engineering Demonstration System surrogate testing, 15:3792 (R;US)
Convention on international trade in endangered species of wild fauna and flora. 1987 annual report. Final report, 15:3613 (R;US)
ANISOLE
Molecular beam studies of oxygen atom reactions with unsaturated hydrocarbons, 15:3109 (R;US)
ANL
In situ tem observations of heavy ion damage in gallium arsenide, 15:2991 (BA;US)
ANODES
Development of high-efficiency molten carbonate fuel cell. Evaluation of stack performance and clarification of degradation mechanism at high fuel utilization, 15:2656 (R;JP;In Japanese)
ANTARCTIC REGIONS
Feasibility study of methods for stopping the depletion of ozone over Antarctica. Final report, 15:3417 (R;US)
Ozone depletion, greenhouse gases, and climate change, 15:3429 (R;US)
ANTENNAS
An assessment of the lifetime of Faraday shield elements, 15:4392 (R;US)
ANTICORROSION
See CORROSION PROTECTION
ANTIFERROMAGNETIC MATERIALS
Phase separation of holes in antiferromagnets, 15:2904 (R;US)
ANTIGEN-ANTIBODY REACTIONS
Antigen-specific composition and in-vivo methods for detecting and localizing an antigenic site and for radiotherapy, 15:3682 (P;US)
ANTIKAONS NEUTRAL
Possible test of *CPT* invariance in neutral-kaon regeneration, 15:4028 (J;US)
ANTIPROTON REACTIONS
Role of mesonic resonances in antiproton annihilation on nuclei, 15:4173 (J;US)
ANTIPROTON SOURCES
Potential for a near-term very-low-energy antiproton source at Brookhaven Bational Laboratory. Special report, 15:3947 (R;US)
ANTIPROTONIC ATOMS
See HADRONIC ATOMS
ANTIPROTONS
Operational experience with Tevatron I antiproton source, 15:3268 (BA;US)
Physics with ultra-low energy antiprotons, 15:4044 (R;US)
ANTIREFLECTION COATINGS
Corrosion-resistant coatings. February 1983-September 1989 (Citations from the NTIS data base). Report for February 1983-September 1989, 15:2848 (R;US)
Single layer $Al_2O_3 \cdot H_2O$ and multilayer $Al_2O_3 \cdot H_2O$–SiO_2 optical coatings prepared from colloidal suspensions, 15:3020 (J;US)
Sol-gel processes. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:2222 (R;US)
APARTMENT BUILDINGS
Measuring heat flows in collective heating systems. Appendices and figures, 15:2703 (R;NL;In (In Dutch))
Measuring heat flows in collective heating systems. Illusion or reality, 15:2702 (R;NL;In (In Dutch))
APPALACHIAN BASIN
Multizone completion opportunities in the Appalachian basin: Final report, 15:2138 (R;US)
APPARATUS
See EQUIPMENT
APPLIANCES
See also STOVES
WATER HEATERS
WOOD BURNING APPLIANCES

A review of assumptions and analysis in EPRI EA-3409: "Household appliance choice: Revision of REEPS [Residential End-use Energy Planning System] behavioral models", 15:2686 (R;US)

APPLICATORS (RADIOTHERAPY)
See RADIATION SOURCES

AQUATIC ECOSYSTEMS
See also WETLANDS
Methods for aquatic toxicity-identification evaluations. Phase 2. Toxicity identification procedures. Technical report, 15:3550 (R;US)
Methods for aquatic toxicity-identification evaluations. Phase 3. Toxicity confirmation procedures. Technical report, 15:3549 (R;US)
Pathogenic regulation of running water macroinvertebrates: Progress report, January 1, 1989–October 15, 1989, 15:3539 (R;US)
Structural properties for determining mechanisms of toxic action, 15:3778 (R;US)

AQUATIC ORGANISMS
See also FISHES
MOLLUSCS
Accumulation patterns of heavy metals and chlorinated hydrocarbons by sea otters, Enhydra lutris, in California. Final report, 15:3788 (R;US)
Oil-spill removal techniques and equipment. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989, 15:2133 (R;US)

AQUEOUS HUMOR
See EYES

AQUEOUS SOLUTIONS
Energy efficient method for evaporating concentrated aqueous solutions of temperature sensitive substances. Phase 1, 15:2733 (R;DK;In Danish)
Ultrasonic and immersion cleaning: a comparison using aqueous and fluorocarbon solvents, 15:2176 (R;GB)

AQUIFERS
In-situ aquifer restoration of chlorinated aliphatics by methanotrophic bacteria. Research report, 1 May 1985-30 April 1989, 15:3554 (R;US)
Use of ground-penetrating radar to define recharge areas in the Central Sand Plain. Technical completion report, 15:3560 (R;US)

ARAGONITE
Dating of aragonite and dolomite from Devil's cave - SP, by dosimetric thermoluminescent method (DTL) and ESR, 15:3057 (R;BR;In Portuguese)

ARCTIC OCEAN
Frost resistance of concrete in artic offshore structures, 15:2755 (R;FI;In Finnish)

AREA POLLUTION SOURCES
See POLLUTION SOURCES

ARGON
Anharmonic damping in rare-gas multilayers, 15:2888 (J;US)
Electron degradation and yields of initial products. VI. Energy spectra of subexcitation electrons in argon and molecular hydrogen, 15:3908 (J;US)
Mixing of gases in large volumes by forced injection, 15:3155 (R;US)
Molecular dynamics for discontinuous potential. IV. Lennard-Jonesium, 15:3089 (J;US)

ARGON 40 REACTIONS
Excitation energy equilibration in damped $^{139}La+^{40}Ar$ collisions at 15 MeV per nucleon, 15:4100 (J;US)
Preequilibrium emission of neutrons in central heavy-ion collisions at 15-20 MeV/A bombarding energy, 15:4086 (RA;DE;In German)
Study of multi-fragmentation in collisions of heavy ions, 15:4096 (RA;DE;In German)

ARGON 40 TARGET
Study of multi-fragmentation in collisions of heavy ions, 15:4096 (RA;DE;In German)

ARGON IONS
Ar^{+}_{3} photodissociation and its mechanisms, 15:3097 (J;US)
Coupled-channel calculations of partial capture cross sections in multiply charged ion collisions with hydrogen, 15:3924 (J;US)

ARGON METHOD
See ISOTOPE DATING

ARGONNE NATIONAL LABORATORY
See ANL

ARMY PERSONNEL
See MILITARY PERSONNEL

AROMATIC COMPOUNDS
See AROMATICS

AROMATICS
See also BENZENE
Gene-enzyme relationships in somatic cells and their organismal derivatives in higher plants: Progress report, August 1, 1988–July 31, 1989, 15:3602 (R;US)
Upgrading of light Fischer-Tropsch products: Quarterly report No. 6, January 1, 1988–March 31, 1988, 15:2264 (R;US)

ARRAY PROCESSORS
Implementation indices (1975-1979). Volume 1. Technical report, 15:4497 (R;US)
Optimization algorithms for new computer architectures with applications to personnel-assignment models. Annual report (Final), 1 May 1988-30 April 1989, 15:4501 (R;US)

ARSENIC COMPOUNDS
See also ARSENIC SELENIDES
Amorphous phase formation by solid-state reaction between polycrystalline Co thin films and single-crystal GaAs, 15:3014 (J;US)
Reduction of arsenic wastes in the electronics industry (application to study). Final report, 15:2748 (R;US)

ARSENIC SELENIDES
Standard molar enthalpies of formation and transition at 298.15 K and other thermodynamic properties of the crystalline and vitreous forms of arsenic sesquiselenide (As_2Se_3): Dissociation enthalpies of As-Se bonds, 15:2968 (R;US)

ARSONIUM COMPOUNDS
See ARSENIC COMPOUNDS

ARTIFICIAL INTELLIGENCE
Applying AI techniques to improve alarm display effectiveness, 15:2247 (BA;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 7. Part A. Time oriented problem solving. Interim report, December 1986-December 1987, 15:4499 (R;US)
The problem of finding a strategy in control binary paramodulation, 15:4506 (R;US)

ASBESTOS
Asbestos and silicate pollution in the work place. January 1978-July 1989 (Citations from Pollution Abstracts). Report for January 1978-July 1989, 15:3461 (R;US)
Asbestos cement dust inhalation by hamsters, 15:3793 (J;US)
Asbestos-fiber reentrainment during vacuuming and wet cleaning of carpet at a captive research site, 15:3437 (R;US)
Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)
Evaluation of airborne-asbestos concentrations before and during an O and M (operations and maintenance) activity: A case study, 15:3451 (R;US)
Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados, 15:3459 (R;US)
Quantitative evaluation of air-filtration systems in use at asbestos abatement sites: Research in progress, 15:3256 (R;US)
Statistical evaluation of airborne asbestos measured before, during, and after abatement, 15:3438 (R;US)

ASDEX TOKAMAK
Lower hybrid current drive activity at Princeton, 15:4337 (RA;JP)

ASHES
See also FLY ASH
Apparatus for direct measurement of ash fusion and sintering behavior at elevated temperatures and pressures, 15:2066 (J;US)

In-situ measurements of coal ash deposit optical properties: Final report, September 11, 1987–September 30, 1989, 15:2096 (R;US)
Mineral matter transformations and slagging in a semi-industrial furnace, 15:2100 (R;NL)
Review on mineral matter transformations and slagging in pulverized coal combustion, 15:2099 (R;NL)
Test plan for valveless ash removal from pressurized fluid bed combustion systems, 15:2095 (R;US)

ASPHALTS
Applicability of the DMSO (dimethyl sulfoxide) aggregate degradation test to determine moisture-induced distress in asphalt-concrete mixes. Final report, June 1986-June 1987, 15:2980 (R;US)

ASTRONAUTS
Effects of iron particles on behavior and brain function: Initial studies, 15:3756 (R;US)

ATF TORSATRON
Proceedings of US-Japan workshop on new generation experiments and reactors (joined by EC), 15:4440 (R;JP)
Second stability in the ATF torsatron, 15:4372 (J;US)

ATLANTIC OCEAN
See also SARGASSO SEA
Boundary processes in the nutrient-bearing stratum of the North Atlantic: Progress report, March 1, 1989–February 28, 1990, 15:3818 (R;US)

ATMOSPHERIC CHEMISTRY
Global tropospheric chemistry: Chemical fluxes in the global atmosphere, 15:3393 (R;US)
Ozone and other issues in global atmospheric chemistry, 15:3394 (B;US)

ATMOSPHERIC CIRCULATION
Beryllium dispersion near explosive firing tables: A comparison of computed and observed results, 15:3468 (R;US)
The identification of terrain-induced circulations using principal components, 15:2230 (R;US)

ATMOSPHERIC EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS

ATMOSPHERIC PRECIPITATIONS
Participation in the MAP3S precipitation chemistry network: Progress report, August 1, 1988–July 31, 1989, 15:3410 (R;US)

ATOM COLLISIONS
See also ATOM-MOLECULE COLLISIONS
International bulletin on atomic and molecular data for fusion. No. 39, 15:4317 (R;XA)

ATOM-MOLECULE COLLISIONS
Direct determination of scattering time delays using the *R*-matrix propagation method, 15:3931 (J;US)

ATOMIC ABSORPTION SPECTROSCOPY
See ABSORPTION SPECTROSCOPY

ATOMIC BOMBS
See NUCLEAR WEAPONS

ATOMIC ENERGY
See NUCLEAR ENERGY

ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS

ATOMIC IONS
Effective *L*-shell fluorescence yields for sodiumlike and neonlike low-lying autoionizing states, 15:3915 (J;US)
Effects of relativity and configuration interaction on *L*-shell Auger and radiative decays of the doubly excited $3l3l'$ states of sodiumlike ions, 15:3911 (J;US)

ATOMIC SHELLS
See ELECTRONIC STRUCTURE

ATOMIC WEAPONS
See NUCLEAR WEAPONS

ATOMS
See also HADRONIC ATOMS
ISOELECTRONIC ATOMS
Fluorescence near a phase-conjugating mirror: Amplification of quantum noise, 15:3929 (J;US)
Natural line shape, 15:3922 (J;US)
One-dimensional model for photodetachment in a static electric field, 15:3912 (J;US)
Solutions to the time-dependent three-dimensional Schroedinger equation: Atoms in intense electric fields, 15:3930 (J;US)

ATP
Control of ATP hydrolysis by ADP bound at the catalytic site of chloroplast ATP synthase as related to protonmotive force and Mg^{2+}, 15:3605 (J;US)

ATP-ASE
Control of ATP hydrolysis by ADP bound at the catalytic site of chloroplast ATP synthase as related to protonmotive force and Mg^{2+}, 15:3605 (J;US)

ATR REACTOR
Development of an aging evaluation and life extension program for the Advanced Test Reactor, 15:2521 (R;US)

AURORAE
Auroral energy deposition over the polar ionosphere during substorms. Technical report, 15:3882 (R;US)
Optical instrumentation support for the airborne ionospheric observatory. Report for 1 July 1987-30 June 1988, 15:3884 (R;US)

AUSTENITIC STEELS
Corrosion database for the nuclear fuel cycle. Sub-project no. 1. Final report, 15:4544 (R;DE;In German)

AUTOIONIZATION
Lasers without inversion: Interference of lifetime-broadened resonances, 15:3152 (R;US)
Non-reciprocity of autoionizing interferences: Lasers without inversion, 15:3151 (R;US)

AUTOMATION
Alternative development programme of the projects concerning the building management control, 15:2682 (R;FI;In Finnish)

AUTOMOBILE EFFICIENCY STANDARDS
See AUTOMOBILES
EFFICIENCY

AUTOMOBILES
Autonomous land navigation in a structured environment, 15:3138 (R;US)

AVIATION FUELS
Compatibility of fuel-system components with high density fuel. Final report, April 1987-January 1989, 15:2781 (R;US)

AXIAL-VECTOR CURRENTS
The role of the axial anomaly in determining spin-dependent parton distributions, 15:3972 (R;US)

B

B CODES
Predicting horizontal/slanted well production by mathematical modeling, 15:2115 (BA;US)

B MESONS
B physics at the Z^0 pole, 15:3966 (R;US)
QCD corrections to weak decays, 15:3982 (R;US)
Rare decays, 15:3965 (R;US)

BACK CONTACT SOLAR CELLS
High volume processing of point contact solar cells, 15:2315 (BA;US)

BACKGROUND RADIATION
Natural background radiation and population dose distribution in India, 15:4190 (R;IN)
The determination of the penetrating radiation dose at Hanford, 15:4195 (R;US)
U, Th and K distributions inferred from regional geology and the terrestrial radiation profiles in India, 15:3505 (R;IN)

BACKWARD WAVE TUBES
Intense microwave radiation from a repetitive backward-wave oscillator driven by a relativistic electron beam, 15:4182 (J;US)

BACTERIA
See also METHANOGENIC BACTERIA
METHANOTROPHIC BACTERIA
Cloning and characterization of the recA gene of Aquaspirillum magnetotacticum, 15:3610 (R;US)
Genetic engineering of single-domain magnetic particles. Progress report, 1 March-15 June 1989, 15:3611 (R;US)

BAG MODEL
Phenomenological hadron form factors and finite size of chiral solitons, 15:3999 (RA;DE)
BALLISTIC MISSILE DEFENSE
Defensive technologies for Europe, 15:3391 (BA;US)
Tracking performance evaluation. Final report, 1 December 1987-31 August 1988, 15:3379 (R;US)
BALLOONS
Kestrel 3 Program: Final report, 15:4488 (R;US)
Technical and methodical developments, 15:3350 (RA;DE;In German)
BANKS
See COMMERCIAL BUILDINGS
BARBADOS
Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados, 15:3459 (R;US)
BARC
Fuel Chemistry Division annual progress report for 1986, 15:2163 (R;IN)
BARIUM COMPOUNDS
See also BARIUM OXIDES
Electronic materials high-T_c superconductivity polymers and composites structural materials surface science and catalysts industry participation: Annual report, 1988, 15:2923 (R;US)
Local atomic displacements in high T_c oxides studied by pulsed neutron scattering, 15:2905 (R;US)
Nature of phonons, isotope effect, and superconductivity in $Ba_{1-x}K_xBiO_3$, 15:2910 (R;US)
Processing and fabrication of high-temperature oxide superconductors. Annual report, 1 August 1988-30 June 1989, 15:2897 (R;US)
Resistivity measurements of superconducting materials. Master's thesis, 15:2932 (R;PK)
BARIUM OXIDES
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)
Anisotropy of oxygen tracer diffusion in $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:2914 (R;US)
Break junction measurement of the tunneling gap of a thallium-based high-temperature superconductor crystal, 15:2950 (J;US)
Dissipation measurement in high T_c superconductors with electromagnetic probes, 15:2916 (R;US)
Effect of heat treatment time and temperature of the properties of $YBa_2Cu_3O_{7-x}$, 15:2945 (J;US)
Ion implantation of sputtered Y-Ba-Cu-O films, 15:2951 (J;US)
Mean-field theory of oxygen-vacancy ordering in $YBa_2Cu_3O_{7-\delta}$, 15:2961 (J;US)
Microstructures of Y123 films on $SrTiO_3$, $LaGaO_3$ and $LaAlO_3$, 15:2922 (R;US)
Microwave characterization of high-temperature superconductors, 15:2921 (R;US)
Photoemission study of monoclinic $BaBiO_3$, 15:2960 (J;US)
States of partial order in $YBa_2Cu_3O_z$, 15:2948 (J;US)
Superconducting energy gap and a normal-state excitation in $Ba_{0.6}K_{0.4}BiO_3$, 15:2958 (J;US)
Tunneling spectroscopy and the electron-phonon interaction in $Ba_{1-x}K_xBiO_3$, 15:4254 (R;US)
[Dynamics of magnetic fluctuations in high-T_c materials]: Foreign trip report, October 5–October 15, 1989, 15:4257 (R;US)
BARYON RESONANCES
See BARYONS
BARYONIUM
Measurement of proton-antiproton cross sections at low momenta, 15:3955 (RA;DE;In German)
BARYONS
See also BEAUTY BARYONS
NUCLEONS
Outlook and perspectives (excited baryons, 1988), 15:3948 (R;US)
Soliton baryons and Goldstone mesons in the cell model of the QCD vacuum, 15:3997 (RA;DE)
BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES
BCC LATTICES
Analytic embedded atom method model for bcc metals, 15:2876 (J;US)
BEAM BENDING MAGNETS
Overview of recent focussing horns for the BNL neutrino program, 15:3269 (BA;US)
BEAM COOLING
See also ELECTRON COOLING
Beam crystallization, 15:3270 (RA;DE;In German)
Laser cooling, 15:3294 (RA;DE;In German)
BEAM CURRENTS
Beam current regulation of DIII-D neutral beam long pulse ion sources, 15:4415 (R;US)
BEAM FOCUSING MAGNETS
Final focus test beam alignment: A draft proposal, 15:3310 (R;US)
Finding the magnetic center of a quadrupole to high resolution: A draft proposal, 15:3309 (R;US)
BEAM MONITORS
Electron beam diagnostics study, 15:3363 (R;FR;In French)
BEAM TRANSPORT
Comparison of photodesorption yields from aluminum stainless and Cu-plated beam tubes, 15:3285 (R;US)
Summary of RLA [Recirculating Linear Accelerator] beam transport experiments using a 1.5 MV injector, 15:3275 (R;US)
BEAM-BEAM INTERACTIONS
Coherent pair creation from beam-beam interaction, 15:3278 (R;US)
BEAM-PLASMA SYSTEMS
Wakefield accelerator in a magnetized electron-positron plasma, 15:3262 (R;XA)
BEAMS (STRUCTURAL)
See STRUCTURAL BEAMS
BEARINGS
See also JOURNAL BEARINGS
Non-destructive radiometry inspection technique for locating reinforcements and void/porosity in bridge bearings, 15:2257 (R;MY)
BEAUTY BARYONS
B physics at the Z^0 pole, 15:3966 (R;US)
BEAUTY PARTICLES
See also BEAUTY BARYONS
B production in hadron collisions: Theory, 15:3973 (R;US)
BEHAVIOR
Effects of iron particles on behavior and brain function: Initial studies, 15:3756 (R;US)
Radiation quality and rat motor performance, 15:3691 (R;US)
BENCH-SCALE EXPERIMENTS
Parallel algorithms for solving the diffusion equation by finite elements methods and by nodal methods, 15:2470 (R;FR;In French)
BENTONITE
Plutonium diffusivity in compacted bentonite, 15:2223 (R;JP)
BENZENE
Upgrading of light Fischer-Tropsch products: Quarterly report No. 6, January 1, 1988–March 31, 1988, 15:2264 (R;US)
BENZOPYRENE
Production of oxidative DNA damage during the metabolic activation of benzo[α]pyrene in human mammary epithelial cells correlates with cell killing, 15:3794 (J;US)
BERKELEY BEVALAC
See BEVALAC
BERYLLIUM
Analyses of particles in beryllium by ion imaging, 15:2856 (R;US)
Beryllium dispersion near explosive firing tables: A comparison of computed and observed results, 15:3468 (R;US)
Effects of nitrogen pulsing on sputter-deposited beryllium films, 15:2855 (R;US)
The optical properties of beryllium, 15:2830 (R;US)
Translation of reports from the first international conference on neutron physics, Kiev, USSR, 14-18 September 1987, 15:4179 (R;XA)

Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987, 15:4416 (R;XA)

BERYLLIUM 7
Atmospheric depositional characteristics of Beryllium 7 and Lead 210 along Southeastern Virginia coast, 15:3490 (J;US)

BERYLLIUM 9 BEAMS
Laser cooling, 15:3294 (RA;DE;In German)

BERYLLIUM 9 TARGET
Contribution of two-pion annihilation to dilepton emission from proton-nucleon collisions, 15:4008 (J;US)

BERYLLIUM MODERATORS
See BERYLLIUM

BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS

BETA DECAY
See also BETA-MINUS DECAY
Proton-neutron quasiparticle RPA and charge-changing transitions, 15:4138 (RA;DE)

BETA SOURCES
Preparation of ^{60}cobalt sources by molecular plating, 15:2254 (RA;DE;In German)

BETA-MINUS DECAY
See also DOUBLE BETA DECAY
Calculation of β^--decay half-lives by the proton-neutron QRPA, 15:4139 (RA;DE;In German)

BETATRON OSCILLATIONS
Successful observation of Schottky signals at the Tevatron collider, 15:3307 (R;US)

BETATRONS
RADLAC-II propagation experiments, 15:3895 (R;US)

BEVALAC
A raster scanning power supply system for controlling relativistic heavy ion beams at the Bevalac biomedical facility, 15:3280 (BA;US)

BHABHA ATOMIC RESEARCH CENTER
See BARC

BIDS
Evaluation methods in competitive bidding for electric power: Volume 2, Technical appendix, 15:2635 (R;US)

BILATERAL AGREEMENTS
Report for the period 1 July 1988–30 June 1989 from the Mineral Resources Administration in Greenland, 15:2600 (R;DK;In Danish)

BINARY ALLOY SYSTEMS
Evaluated phase diagrams of binary metal-tellurium systems of the D-block transition elements, 15:2811 (R;IN)
Kinetic paths of B2 and DO_3 order parameters: Theory, 15:2871 (J;US)

BINARY MIXTURES
Viscosity of a phase-separating critical mixture, 15:3210 (J;US)

BINARY STARS
Gravitational radiation from primordial solitons and soliton-star binaries, 15:4292 (J;US)

BIOASSAY
Comparison of bioassays for assessing sediment toxicity in Puget Sound. (Appendices included). Report for 1988-1989 (Final), 15:3561 (R;US)

BIOCENOSES
See ECOSYSTEMS

BIOCHEMICAL ACTIVITY
See BIOCHEMISTRY

BIOCHEMICAL REACTION KINETICS
Gene-enzyme relationships in somatic cells and their organismal derivatives in higher plants: Progress report, August 1, 1988–July 31, 1989, 15:3602 (R;US)

BIOCHEMISTRY
Molecular biology and physiology of methanogenic archaebacteria. Annual report, July 1988-June 1989, 15:3596 (R;US)

BIOCONVERSION
Development of a container for pumps, measuring equipment and motorgenerators in connection with a bioconversion energy system, 15:2297 (R;DK;In Danish)

BIOGAS
See METHANE

BIOGEOCENOSES
See ECOSYSTEMS

BIOLOGICAL MATERIALS
Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)

BIOLOGICAL RADIATION EFFECTS
See also RADIATION INJURIES
Treatment planning for stereotactic heavy-charged particle radiosurgery of the brain, 15:3677 (R;US)

BIOLOGICAL STRESS
Assessment of smolt condition for travel time analysis: Annual report 1988, 15:2279 (R;US)

BIOLOGICAL TESTING
See BIOASSAY

BIOMASS
A collaborative effort to model plant response to acidic rain, 15:3404 (R;US)
Microcomputer Scientific Software Series 5: The Biomass User's Manual. Forest Service general technical report, 15:2298 (R;US)

BIOMASS PLANTATIONS
Geographic variation in red alder. Forest Service research paper, 15:2299 (R;US)

BIOMEDICAL RADIOGRAPHY
Advanced methods of instantaneous zonography of temporal bone pyramids, 15:3630 (RA;SU;In Russian)
Handbook of selected tissue doses for projections common in diagnostic radiology, 15:3679 (R;US)
Possibilities of stomach X-ray examination in low exposure dose, 15:3633 (RA;SU;In Russian)
Use of color interpretation of roentgrams of chest organs, 15:3629 (RA;SU;In Russian)

BIOTECHNOLOGY
Biotechnology research and development activities in industry: 1984 and 1985. Surveys of Science Resources series, 15:3604 (R;US)

BIRDS
See also FOWL
Establishment of a viable population of red-cockaded woodpeckers at the Savannah River Site: Progress report, FY 1989, 15:3492 (R;US)

BIS(CHLORETHYL)AMINE
See NITROGEN MUSTARD

BISMUTH COMPOUNDS
See also BISMUTH OXIDES
Synthesis conductivity, and X-ray photoelectron spectrum of $Bi_2Sr_2Cu_{7+x}$. A new ternary bismuth-oxide system exhibiting metallic conductivity, 15:4252 (R;US)

BISMUTH OXIDES
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)
Effects of oxygen and strontium vacancies on the superconductivity of single crystals of $Bi_2Sr_{2-x}CuO_{6-y}$, 15:2959 (J;US)
Lattice defects and flux pinning in crystallized metal-oxide glasses in the Bi-Sr-Ca-Cu-O system, 15:2947 (J;US)
Nature of phonons, isotope effect, and superconductivity in $Ba_{1-x}K_xBiO_3$, 15:2910 (R;US)
Photoemission study of monoclinic $BaBiO_3$, 15:2960 (J;US)
Superconducting energy gap and a normal-state excitation in $Ba_{0.6}K_{0.4}BiO_3$, 15:2958 (J;US)
The effect of composition and processing on high T_c superconductors containing bismuth, 15:2909 (R;US)
Variation of T_{c0} in the 110 K superconductor $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$, 15:2949 (J;US)

BITTER SPAR
See DOLOMITE

BITUMENS
See also ASPHALTS

Synthetic fuels from coal-heavy oil mixtures. Phase 1. A survey of the work applicable to coal bitumen mixtures as synthetic fuels feedstock, 15:2027 (R;CA)

BITUMINOUS COAL
Gas content in sealed Argonne Premium Coal Samples, 15:2051 (R;US)

BLACK COAL
See also BITUMINOUS COAL
Investigation of explosion with delayed start ($\geq$ 150 m) and methods of prevention. Final report, 15:2104 (R;DE;In German)

BLACK LUNG DISEASE
See PNEUMOCONIOSES

BLADDER
Case-control study of bladder cancer in Massachusetts among populations receiving chlorinated and chloraminated drinking water, 15:3771 (R;US)

BLADES (TURBINES)
See TURBINE BLADES

BLANKETS (BREEDING)
See BREEDING BLANKETS

BLAST EFFECTS
Modeling casualties in nuclear warfare. Final report, 15:3385 (R;US)

BLASTS
See EXPLOSIONS

BLOOD CIRCULATION
Method of synchronous determination of linear blood flow time in arteries and veins separately, 15:3634 (RA;SU;In Russian)

BLOWERS
Fan pressurization test results from the residential construction demonstration project: Cycle 1, 15:2666 (R;US)

BNL
Overview of recent focussing horns for the BNL neutrino program, 15:3269 (BA;US)

BODY CENTERED CUBIC
See BCC LATTICES

BOILERS
See also FLUIDIZED BED BOILERS
REFUSE-FUELED BOILERS
WASTE HEAT BOILERS
Advanced gas-turbine steam-injection program water treatment for steam-injected gas-turbine systems. Topical report, October 1987-March 1989, 15:2417 (R;US)
Development of a data-processing model for steady turbulent 3-D gas particle flow, 15:3110 (R;DK;In Danish, English)
Measurements of gas concentrations and temperature in a boiler room, 15:2428 (R;DK;In Danish)
Numerical integration method of radiative exchange (NIMREX), 15:3113 (RA;DK)
User manual and program documentation for the "TUFCA" flow program, 15:3112 (RA;DK;In Danish)

BOILING WATER COOLED AND MODERATED REACTOR
See BWR TYPE REACTORS

BOMBS
Reverse Hopkinson bar testing, 15:3389 (R;US)

BONE MARROW
Acute radiation syndrome in the ^{137}Cs Brazilian accident, 1987, 15:3698 (R;BR)

BONNEVILLE POWER ADMINISTRATION
Research and Development report: Fiscal years 1987–1988, 15:2607 (R;US)
Summary of commercial conservation programs environmental issues and program consistency, 15:3517 (R;US)
Summary of residential environmental issues and program consistency, 15:2698 (R;US)

BORANES
Further theoretical studies on B_2H_4 and $B_2H^+_4$, 15:2953 (J;US)
Laser photoelectron spectroscopy of ions: Progress report, 1988–1989, 15:3095 (R;US)

BOREHOLES
Oil wells and gas wells: aspects of radiological safety, 15:2123 (R;BR;In Portuguese)
Pilot project for a larger solar heating system with seasonal heat storage. Further documentation of borehole storage yield and economy, 15:2352 (R;DK;In Danish)
The Waste Isolation Pilot Plant (WIPP) Seal System Performance Program, 15:2236 (R;US)

BORIC ACID
Characterisation of molecular boric acid by mass spectrometry and matrix isolation-infrared spectroscopy, 15:3068 (R;GB)
New estimates for the thermodynamic functions of molecular boric acid, 15:3069 (R;GB)

BORON
Neutron capture therapy for melanoma, 15:3615 (R;US)
Structure determination of the Si(111):B($\sqrt{3}\times\sqrt{3}$)*R*30° surface: Subsurface substitutional doping, 15:3006 (J;US)

BORON 10
Thiourea derivatives: Process for their production and for their use for neutron capture therapy of malignant melanomas, 15:3618 (TG;US)

BORON COMPOUNDS
See also BORANES
BORON HYDRIDES
Synthesis and properties of new preceramic materials: Research progress report, December 1, 1988–November 30, 1989, 15:2970 (R;US)

BORON HYDRIDES
Further theoretical studies on B_2H_4 and $B_2H^+_4$, 15:2953 (J;US)
Molecular structure and thermal stability of B_2H_4 and $B_2H^+_4$ species, 15:2952 (J;US)
Structure and bonding in the B_2H_5 radical and cation, 15:3927 (J;US)
Theoretical study of the ionization of B_2H_5, 15:3928 (J;US)
Theroretical study of $B_2H^+_3$, $B_2H^+_2$, and B_2H^+, 15:3934 (J;US)

BORON INJECTION
See SAFETY INJECTION

BOROSILICATE GLASS
A kinetic model for dissolution of borosilicate glass, 15:2240 (R;US)
Static leaching of actinides and fission products from fully radioactive waste glass of HLLW generated in Tokai reprocessing plant, 15:2224 (R;JP)

BOROSILICATES
See BOROSILICATE GLASS

BOSONS
See also GLUONS
Sewing relations and duality for BRST off-shell string tadpole amplitudes, 15:4009 (J;US)

BOTTOM BARYONS
See BEAUTY BARYONS

BOTTOM PARTICLES
See BEAUTY PARTICLES

BOUNDARIES (GRAIN)
See GRAIN BOUNDARIES

BOUNDARY VALUE PROBLEMS
See BOUNDARY-VALUE PROBLEMS

BOUNDARY-VALUE PROBLEMS
Iterative methods of domain decomposition with cross-points for the solution of discrete elliptic problems, 15:4518 (R;SU)

BPA
See BONNEVILLE POWER ADMINISTRATION

BRACKISH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

BRAIN
See also HIPPOCAMPUS
Effects of iron particles on behavior and brain function: Initial studies, 15:3756 (R;US)
Treatment planning for stereotactic heavy-charged particle radiosurgery of the brain, 15:3677 (R;US)

BRAZILIAN CNEN
Description of the objectives and activities of Radioprotection and Dosimetry Institute - IRD, 15:4493 (R;BR;In Portuguese)

BREAKERS (CIRCUIT)
See CIRCUIT BREAKERS

BREEDING BLANKETS
The lithium blanket program at the LOTUS facility, 15:4465 (BA;US)
BREMSSTRAHLUNG (MAGNETIC)
See SYNCHROTRON RADIATION
BRINES
Maintenance of brine transparency in salinity gradient solar ponds, 15:2349 (BA;US)
BRONCHOGENIC CARCINOMA
See CARCINOMAS
RESPIRATORY SYSTEM DISEASES
BROOKHAVEN HIGH FLUX BEAM REACTOR
See HFBR REACTOR
BROOKHAVEN NATIONAL LABORATORY
See BNL
BROOKHAVEN RHIC
High energy heavy ion collisions and the RHIC [Relativistic Heavy Ion Collider] project at Brookhaven, 15:3261 (R;US)
BROWN COAL
See also LIGNITE
Special problems in the exploration and operation of loose-rock open-pit mines in developing and threshold countries, 15:2082 (RA;DE;In German)
BROWNS FERRY-2 REACTOR
Safety evaluation report on Tennessee Valley Authority: Browns Ferry nuclear performance plan: Browns Ferry Unit 2 restart: Volume 3, Supplement 1, 15:2536 (R;US)
BUBBLES
The influence of texture on steady foam flow in Berea sandstone, 15:2111 (R;US)
BUDS
Bud irradiation to obtain resistence to citrus canker through induction of mutation, 15:3686 (R;BR;In Portuguese)
BUILDING CODES
Northwest Residential Radon Standard: Volume 1, Project report, 15:2668 (R;US)
BUILDING MATERIALS
See also CEMENTS
CONCRETES
Compliance testing of the Eglin AFB (Air Force Base) asphalt-concrete Batch Plant, Eglin AFB, Florida. Final report, 5-11 March 1989, 15:3403 (R;US)
Development of an inventory of materials potentially sensitive to ambient atmospheric acidity in the South Coast Air Basin. Final report, 15:3558 (R;US)
HRIS (Highway Research Information Service) Abstracts. Volume 21, Number 4 - Winter 1988, 15:2713 (R;US)
Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska, 15:2717 (R;US)
Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska, 15:2716 (R;US)
Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska, 15:2721 (R;US)
Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska, 15:2723 (R;US)
Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska, 15:2722 (R;US)
Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska, 15:2720 (R;US)
Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska, 15:2719 (R;US)
BUILDINGS
See also COMMERCIAL BUILDINGS
HOSPITALS
OFFICE BUILDINGS
PREFABRICATED BUILDINGS
PUBLIC BUILDINGS
RESIDENTIAL BUILDINGS
SCHOOL BUILDINGS
Alternative development programme of the projects concerning the building management control, 15:2682 (R;FI;In Finnish)
Center for Building Science of the Applied Science Division annual report, FY 1988, 15:2689 (R;US)
Construction standards and practices, SNiP II-7-81: Part 2, Design standards: Chapter 7, Construction in seismic regions, 15:3806 (TG;US)
Design instructions for ventilation of day-care centres, 15:2684 (R;FI;In Finnish)
Determination and application of bidirectional solar-optical properties of fenestration systems, 15:2335 (BA;US)
Evaluation of airborne-asbestos concentrations before and during an O and M (operations and maintenance) activity: A case study, 15:3451 (R;US)
Evaluation of the thermal performance of the building envelope of existing buildings, 15:2707 (R;FI;In Finnish)
Experimental and theoretical investigation of passive use of solar energy on house facades, 15:2676 (R;DE;In German)
Indoor air quality: Selected references, 15:3448 (R;US)
Options and techniques for enhanced waste heat recovery in small- and medium-sized enterprises. A guideline, 15:2731 (R;DE;In German)
Seismic design criteria at the Idaho National Engineering Laboratory (INEL), 15:3808 (R;US)
Short-time-scale measurements of fenestration thermal performance under realistic springtime conditions, 15:2343 (BA;US)
Three-dimensional modeling of heat transfer from slab floors. Final report, 15:2661 (R;US)
BURNERS
Determination of compatibility conditions of the burner/boiler system of heating equipment with a view to energy conservation by means of optimum adjustment of components. Final report. Pt. 3. Investigations of pressure swings in the starting process in a burner/boiler system, 15:3235 (R;DE;In German)
BURSA OF FABRICIUS
See BIRDS
BUTADIENE
A new polymer-based hydrogen getter, 15:2993 (BA;US)
BUTANE
X-ray diffraction study of liquid *n*-butane at 140 and 267 K, 15:3088 (J;US)
BWR TYPE REACTORS
See also BROWNS FERRY-2 REACTOR
FITZPATRICK REACTOR
TVO-1 REACTOR
TVO-2 REACTOR
Advancements in the behavioral modeling of fuel elements and related structures, 15:2504 (R;US)
Assessment of RELAP5/MOD2, Cycle 36.04 against FIX-II split break experiment No. 3051, 15:2552 (R;US)
Closeout of IE Bulletin 86-01: Minimum flow logic problems that could disable residual heat removal pumps: Minimum flow logic problems that could disable residual heat removal pumps, 15:2544 (R;US)
Deposition of cobalt on surface-treated stainless steel under PWR conditions, 15:2445 (R;US)
Design and operation of gamma scan and fission gas sampling systems for characterization of irradiated commercial nuclear fuel, 15:2440 (R;US)
Embrittlement of cast stainless steels in LWR systems, 15:2513 (R;US)
In-core thermal hydraulic and fission product calculations for severe fuel damage analyses, 15:2438 (R;US)
Radioactive materials released from nuclear power plants: Annual report, 1987, 15:2540 (R;US)
Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)
[Integrity of pressure components of nuclear power plants]: Foreign trip report, October 3, 1989–October 20, 1989, 15:2553 (R;US)

C

CABLES (ELECTRIC)
See ELECTRIC CABLES

CADMIUM
Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)

CADMIUM 122
Systematics of the (^{18}O,^{20}Ne) reaction and the determination of the mass excess of ^{122}Cd, 15:4093 (RA;DE;In German)

CADMIUM ISOTOPES
See also CADMIUM 122
Neutron cross sections of tin and cadmium isotopes in the range of 0.5-2.0 MeV, 15:4098 (RA;SU;In Russian)

CADMIUM TELLURIDE SOLAR CELLS
High-efficiency large-area CdTe modules: Annual subcontract report, 1 July 1988–30 June 1989, 15:2306 (R;US)

CADMIUM TELLURIDES
High energy ion beam annealing in implanted CdTe, 15:2994 (BA;US)
Lattice relaxation of *DX*-like donors in $Zn_xCd_{1-x}Te$, 15:3029 (J;US)

CALCITE
Thermoluminescent of induced calcite by gamma and ultraviolet radiation, 15:4225 (R;BR;In Portuguese)

CALCIUM
A cross-sectional TEM study of the effects of annealing conditions on the regrowth of lead-implanted single crystal calcium titanate, 15:2941 (BA;US)

CALCIUM 40 TARGET
Dirac random-phase-approximation analysis of the inelastic scattering of 500 MeV protons from ^{40}Ca, 15:4170 (J;US)
Muon capture at large y-energetic nucleon emission, 15:4083 (R;US)
Preequilibrium emission of neutrons in central heavy-ion collisions at 15-20 MeV/A bombarding energy, 15:4086 (RA;DE;In German)

CALCIUM 48 TARGET
Preparation of isotopically pure ^{48}Ca-targets by ion implantation in C-foils, 15:3292 (RA;DE;In German)

CALCIUM CARBONATES
See also ARAGONITE
CALCITE
DOLOMITE
The effects of heavy metals on the scaling ability of $CaCO_3$ and $Mg(OH)_2$, 15:3041 (R;US)

CALCIUM COMPOUNDS
See also CALCIUM CARBONATES
CALCIUM HYDROXIDES
CALCIUM OXIDES
CALCIUM SILICATES
CALCIUM SULFATES
Local atomic displacements in high T_c oxides studied by pulsed neutron scattering, 15:2905 (R;US)

CALCIUM HYDROXIDES
Bench-scale evaluation of calcium sorbents for acid-gas emission control. Report for October 1988-March 1989, 15:3444 (R;US)
Calcination of calcium hydroxide sorbent in the presence of SO_2 and its effect on reactivity. Report for October 1988-March 1989, 15:3443 (R;US)
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 5, July 1–September 30, 1989, 15:2424 (R;US)

CALCIUM OXIDES
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)
Break junction measurement of the tunneling gap of a thallium-based high-temperature superconductor crystal, 15:2950 (J;US)
Electron paramagnetic resonance investigations of divalent cobalt in single crystals of perovskite ($CaTiO_3$), 15:3023 (J;US)
Lattice defects and flux pinning in crystallized metal-oxide glasses in the Bi-Sr-Ca-Cu-O system, 15:2947 (J;US)
Microwave characterization of high-temperature superconductors, 15:2921 (R;US)
Pore structure and reactivity changes in hot coal gas desulfurization sorbents: Technical progress report, July–September 1989, 15:2067 (R;US)
The effect of composition and processing on high T_c superconductors containing bismuth, 15:2909 (R;US)
Variation of T_{c0} in the 110 K superconductor $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$, 15:2949 (J;US)

CALCIUM SILICATES
Bench-scale evaluation of calcium sorbents for acid-gas emission control. Report for October 1988-March 1989, 15:3444 (R;US)

CALCIUM SULFATES
Calcination of calcium hydroxide sorbent in the presence of SO_2 and its effect on reactivity. Report for October 1988-March 1989, 15:3443 (R;US)

CALIFORNIA
See also LOS ANGELES
Characterization of year-round sensitivity of California's Montane Lakes to acidic deposition. Final report, October 1986-June 1989, 15:3552 (R;US)
Development of an inventory of materials potentially sensitive to ambient atmospheric acidity in the South Coast Air Basin. Final report, 15:3558 (R;US)
Measurement of on-road vehicle emission factors in the California South Coast Air Basin. Volume 1. Regulated emissions. Final report, 15:2796 (R;US)
Soil water and vegetation management for cleanup of selenium contaminated soils: Progress report, 15:3498 (R;US)

CALORIMETERS (PARTICLE)
See SHOWER COUNTERS

CAMERAS
Use of a charge-coupled device camera for broadband coherent anti-Stokes Raman scattering measurements, 15:3377 (J;US)

CANADA
See also ALBERTA
Canadian natural gas: Export potential, 15:2144 (R;CA)
Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook, 15:2601 (R;US)
Specifying monthly mean surface temperatures in Canada and Alaska from the 500 mb height field, 15:3398 (J;US)
US and Canadian emissions inventory, 1985. Report for March-September 1988, 15:3442 (R;US)

CANADIAN ORGANIZATIONS
Alberta/Canada Energy Resources Fund annual review, 1987-88, 15:2603 (R;CA;In English and French)

CANCER
See NEOPLASMS

CANISTERS
See CONTAINERS

CANONICAL EQUATIONS
See DIFFERENTIAL EQUATIONS

CANONICAL QUANTUM FIELD THEORY
See LAGRANGIAN FIELD THEORY

CAPACITIVE ENERGY STORAGE EQUIPMENT
Capacitive energy storage at cryogenic temperatures. Phase 2. Final report, 1 January 1986-31 December 1988, 15:2560 (R;US)

CAPACITORS
Capacitive energy storage at cryogenic temperatures. Phase 2. Final report, 1 January 1986-31 December 1988, 15:2560 (R;US)

CARBENES
High resolution spectroscopic detection of acetylene–vinylidene isomerization by spectral cross correlation, 15:3084 (J;US)

CARBIDES
See also NIOBIUM CARBIDES
SILICON CARBIDES
TUNGSTEN CARBIDES
Aspects of faceting in the study of percipitate interfaces, 15:2841 (R;US)

CARBINOL
See METHANOL

CARBON
See also DIAMONDS
GRAPHITE
Continuous high-temperature lubrication of ceramics by carbon generated catalytically, 15:2900 (R;US)
Electronic bonding of buried interfaces determined by soft x-ray emission spectroscopy, 15:3019 (J;US)
Ion beam and plasma methods of producing diamondlike carbon films, 15:2929 (R;US)
Laser-induced-fluorescence spectroscopy of jet-cooled C_3, 15:3116 (J;US)
Low density microcellular carbon foams and method of preparation, 15:3036 (P;US)
[Graphite and carbon/carbon composition]: Foreign trip report, September 17, 1988–September 28, 1988, 15:2979 (R;US)

CARBON 11
New techniques for positron emission tomography in the study of human neurological disorders: Progress report, June 15, 1987–November 15, 1989, 15:3616 (R;US)

CARBON 12 REACTIONS
Effect of vacuum polarization on the sub-Coulomb ^{12}C-^{12}C scattering, 15:4077 (RA;DE;In German)
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)

CARBON 12 TARGET
Deep-inelastic myon-nucleus scattering at the CERN SPS; EMC and NMC Collaboration, 15:3956 (RA;DE;In German)
Effect of vacuum polarization on the sub-Coulomb ^{12}C-^{12}C scattering, 15:4077 (RA;DE;In German)
The interference term between nuclear charge and nuclear current matrix elements of the E1 giant resonance in ^{12}C and ^{58}Ni, 15:4075 (RA;DE;In German)
Time of flight measurements at the pulsed proton beam, 15:4076 (RA;DE;In German)
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)

CARBON 14 TARGET
Pion induced double-charge exchange above the resonance, 15:4160 (R;US)

CARBON ADDITIONS
Strain aging in tungsten-heavy alloys. Final report, 15:2810 (R;US)

CARBON DIOXIDE
A county-level approach to regional resource analysis based on climate simulation, 15:3396 (J;US)
Carbon dioxide and climate: Summaries of research in FY 1989, 15:3409 (R;US)
Effects of air pollutants on photosynthesis, vegetative growth, and development of grapevines in the San Joaquin Valley of California. Final report, February 1987-February 1989, 15:3445 (R;US)
Effects of atmospheric mix and toxic fumes on military performance, 15:3777 (R;US)
Energy transfer studies with lasers, 15:3904 (J;US)
Quantum state-resolved study of pure rotational excitation of CO_2 by hot atoms, 15:3933 (J;US)
Seasonal climatic changes induced by doubled CO_2 as simulated by the OSU atmospheric GCM/mixed-layer ocean model, 15:3471 (J;US)
[The role of oceans in determining atmospheric CO_2]: Foreign trip report, October 14, 1989–October 22, 1989, 15:3425 (R;US)

CARBON DIOXIDE LASERS
Noise levels in a tunable CO_2 laser source, 15:3147 (R;US)

CARBON IONS
A review of radiative and dielectronic recombination for C and O ions, 15:3899 (J;SE)
Dielectronic recombination, 15:3890 (RA;DE;In German)
Laser-induced electron-ion interaction, 15:3889 (RA;DE;In German)

CARBON MONOXIDE
Effects of atmospheric mix and toxic fumes on military performance, 15:3777 (R;US)
Human-health studies of carbon monoxide (CO) under conditions of military weapons systems crewman exposures. Protocol 1: Formation of cohb. Final report, September 1982-March 1985, 15:3755 (R;US)
Optical second harmonic generation from Ni(110) with adsorbed CO, 15:2879 (J;US)
Photofragmentation of ketene to $CH_2(\tilde{X}^3B_1)$ + CO: Dissociation rate, energy release and exit barrier height, 15:3096 (R;US)

CARBON STEELS
See also STEEL-ASTM-A212
Effect of heat treatment of toughness and strength properties of C-Mn steel, 15:2850 (R;MY)
Metal wastage analysis of carbon steel tubes in FBC environment, 15:2093 (R;US)
Steel initiative: Development of superplastic steel processing: First annual progress report, March 15, 1988–March 15, 1989, 15:2827 (R;US)

CARBONACEOUS MATERIALS
See also COAL
Carbonaceous film coating, 15:3038 (P;US)

CARBOXYHEMOGLOBIN
Human-health studies of carbon monoxide (CO) under conditions of military weapons systems crewman exposures. Protocol 1: Formation of cohb. Final report, September 1982-March 1985, 15:3755 (R;US)

CARCINOGEN SCREENING
Utility of short-term tests for genetic toxicity, 15:3612 (R;US)

CARCINOGENESIS
EPA (Environmental Protection Agency) programs and the regulation of carcinogens: Methods and philosophies. Technical report, 15:3786 (R;US)

CARCINOGENS
Complex mixtures of urban air pollutants: Identification and comparative assessment of mutagenic and tumorigenic chemicals and emission sources, 15:3784 (R;US)
EPA (Environmental Protection Agency) programs and the regulation of carcinogens: Methods and philosophies. Technical report, 15:3786 (R;US)
Genetic activity profiles: Use in management of risk from genotoxic substances in the environment, 15:3766 (R;US)
Genetic-activity profiles and hazard assessment, 15:3768 (R;US)
Registry of Toxic Effects of Chemical Substances (RTECS), 1988 computer tape. Data file, 15:3790 (R;US)
Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)
Use of genotoxic activity profiles in assessment of carcinogenesis and transmissible genetic effects, 15:3775 (R;US)
Utility of short-term tests for genetic toxicity, 15:3612 (R;US)

CARCINOMAS
Afterloading
Dependence of local radiation complications on methods of intracavitary gamma-therapy in concomitant radiotherapy of stage 1 cervix uteri carcinoma, 15:3741 (RA;SU;In Russian)

Anoxia
Modifying action of gaseous hypoxia in radiotherapy of pulmonary cancer, 15:3668 (RA;SU;In Russian)

Chemotherapy
Immediate results of concomitant radiotherapy of advanced forms of cervix uteri carcinoma with the use of thymaline, 15:3663 (RA;SU;In Russian)
Immunologic status of patients with epidermoid lung cancer in radiotherapy on split course and chemoimmunotherapy, 15:3665 (RA;SU;In Russian)
Potentialities of 100 per cent objective effect receiving during chemoradiation therapy of patients with small cell lung carcinoma, 15:3649 (RA;SU;In Russian)

Fractionated Irradiation
Injuries of healthy tissues in nontraditional regimen of dose fractionating in patients with cervix uteri carcinoma, 15:3662 (RA;SU;In Russian)

Hyperglycemia
Results of combined treatment of patients with pulmonary carcinoma using artificial hyperglycemia, 15:3667 (RA;SU;In Russian)

Immunotherapy
Immediate results of concomitant radiotherapy of advanced forms of cervix uteri carcinoma with the use of thymaline, 15:3663 (RA;SU;In Russian)
Immunologic status of patients with epidermoid lung cancer in radiotherapy on split course and chemoimmunotherapy, 15:3665 (RA;SU;In Russian)

Radiocolloids
Radioactive colloid gold ^{198}Au in combined treatment of lung cancer, 15:3674 (RA;SU;In Russian)

Radiosensitivity
Evaluation of radiocurability of small cell pulmonary carcinoma according to full value of local control during radiotherapy in clinic, 15:3638 (RA;SU;In Russian)

Radiotherapy
15-th experience on application of non-standard dose fractionating in radiotherapy of patients with lung carcinoma, 15:3648 (RA;SU;In Russian)
Basis for use of combined treatment of patients with corpus uteri carcinoma including preoperative irradiation, 15:3658 (RA;SU;In Russian)
Comparative evaluation of efficiency of radiation and surgecal treatment of microinvasive cervix uteri carcinoma, 15:3651 (RA;SU;In Russian)
Comparative evaluation of efficiency of two methods of preoperative radiotherapy of patients with lung carcinoma, 15:3656 (RA;SU;In Russian)
Conservative and surgical treatment of rectovaginal fistulas induced by irradiation, 15:3737 (RA;SU;In Russian)
Evaluation of radiocurability of small cell pulmonary carcinoma according to full value of local control during radiotherapy in clinic, 15:3638 (RA;SU;In Russian)
Immediate results of concomitant radiotherapy of advanced forms of cervix uteri carcinoma with the use of thymaline, 15:3663 (RA;SU;In Russian)
Immunologic status of patients with epidermoid lung cancer in radiotherapy on split course and chemoimmunotherapy, 15:3665 (RA;SU;In Russian)
Injuries of healthy tissues in nontraditional regimen of dose fractionating in patients with cervix uteri carcinoma, 15:3662 (RA;SU;In Russian)
Local radiation injuries after radiotherapy on radical program in patients with locally disseminated lung carcinoma subjected to exploratory thorocotomy, 15:3743 (RA;SU;In Russian)
Modifying action of gaseous hypoxia in radiotherapy of pulmonary cancer, 15:3668 (RA;SU;In Russian)
Peculiarities of testing and introduction into clinical practice of Selectron installation in Research Institute of Health Ministry of Byelorussian SSR, 15:3669 (RA;SU;In Russian)
Potentialities of 100 per cent objective effect receiving during chemoradiation therapy of patients with small cell lung carcinoma, 15:3649 (RA;SU;In Russian)
Potentialities of Simulix-Simtomix complex use for preradiation preparation of patients with lung cancer, 15:3647 (RA;SU;In Russian)
Quality garantee of radiotherapy of patients with lung cancer, 15:3650 (RA;SU;In Russian)
Radiation response in patients with pulmonary carcinoma during remote gamma therapy by means of dynamic multifractionating, 15:3642 (RA;SU;In Russian)
Radioactive colloid gold ^{198}Au in combined treatment of lung cancer, 15:3674 (RA;SU;In Russian)
Results of combined treatment of patients with pulmonary carcinoma using artificial hyperglycemia, 15:3667 (RA;SU;In Russian)

Surgery
Basis for use of combined treatment of patients with corpus uteri carcinoma including preoperative irradiation, 15:3658 (RA;SU;In Russian)
Comparative evaluation of efficiency of radiation and surgecal treatment of microinvasive cervix uteri carcinoma, 15:3651 (RA;SU;In Russian)
Radioactive colloid gold ^{198}Au in combined treatment of lung cancer, 15:3674 (RA;SU;In Russian)

CARDIAC OUTPUT
See BLOOD CIRCULATION

CARDIAC PACEMAKERS
Use of lithium batteries in biomedical devices. Technical report No. 8, July 1988-June 1989, 15:2569 (R;US)

CASKS
See also SPENT FUEL CASKS
Three-dimensional effects in flask impact testing, 15:3123 (R;GB)

CASTE (INSECTS)
See POPULATIONS

CATALYSIS
Electronic materials high-T_c superconductivity polymers and composites structural materials surface science and catalysts industry participation: Annual report, 1988, 15:2923 (R;US)

CATALYSTS
Comprehensive characterization studies of sulfided molybdenum catalysts: Final progress report, 15:2828 (R;US)
Development of thermal-resistant catalysts, 15:2795 (R;JP)
Investigation of the formation and chemical aspects of coke deposits occurring on acid, monofunctional zeolite catalysts through typical reactions with hydrocarbons, 15:2270 (R;DE;In German)
Stable isotope studies: Progress report, October 1988–October 1989, 15:3075 (R;US)

CATALYTIC COMBUSTORS
Pulsating catalytic combustion of gaseous fuels. Final report, January 1987-September 1988, 15:2152 (R;US)

CATALYTIC CONVERTERS
Development of thermal-resistant catalysts, 15:2795 (R;JP)

CATAPHORESIS
See ELECTROPHORESIS

CATHODES
Cell performance of ultra-thin polymer-cathode system: Theoretical energy and power-density projections. Technical report No. 3, July 1988-June 1989, 15:2568 (R;US)
Impedance analysis of ionic transport in polypyrrole-polyazulene copolymer and its charge-discharge characteristics. Technical report, July 1988-June 1989, 15:2571 (R;US)
Rechargeable lithium/polymer cathode batteries. Technical report, July 1988-June 1989, 15:2570 (R;US)

CAVITY RECEIVERS
Comparison of a cavity solar receiver numerical model and experimental data, 15:2326 (BA;US)

CCD
See CHARGE-COUPLED DEVICES

CELL GROWTH (ANIMAL)
See ANIMAL CELLS

CELL NUCLEI
The microdosimetry of radon decay products in the respiratory tract, 15:3748 (R;US)

CELLS (ANIMAL)
See ANIMAL CELLS

CELLS (BACTERIAL)
See BACTERIA

CELLS (ELECTROLYTIC)
See ELECTROLYTIC CELLS

CELLULOSE
Cellulose and lignin: Biodegradation. June 1987-September 1989 (Citations from the Life Sciences Collection data base). Report for June 1987-September 1989, 15:2300 (R;US)

CEMENTS
Evolution of pH in a radwaste repository: internal reactions between concrete constituents, 15:2178 (R;GB)
Immobilisation in cement of ion exchange resins arising from the purification of reagents used for the decontamination of reactor circuits. Fourth semestrial report January-June 1988, 15:2175 (R;GB)
Use of foaming mud cement to terminate underground coal fires and to control subsidence of burn cavities. Final report, 15:2091 (R;US)
Workshop on cement stabilization of low-level radioactive waste: Proceedings, 15:2214 (R;US)

CENTRAL NERVOUS SYSTEM
See also BRAIN

Electrophysiological systems for neurotoxicity field testing: PEARL II and alternatives, 15:3780 (R;US)

CENTRAL RECEIVERS
An assessment of the optical performance of stretched-membrane mirror modules, 15:2328 (BA;US)
Drop ejection in molten-salt direct absorption central receivers, 15:2324 (BA;US)
Potential of advanced-design solar central receiver power systems, 15:2321 (BA;US)
Structural integrity studies of an external direct absorption solar central receiver, 15:2329 (BA;US)
The economic potential of a photovoltaic central receiver power plant, 15:2322 (BA;US)

CENTRIFUGES
Magnetically suspended centrifuge for studies of nonlinear phenomena in stratified fluids: Developmental aspects, 15:3211 (J;US)

CEPHEIDS
The evolution of variable stars, 15:3870 (BA;US)

CERAMICS
Capacitive energy storage at cryogenic temperatures. Phase 2. Final report, 1 January 1986-31 December 1988, 15:2560 (R;US)
Ceramics for transportation engines - siren or solution, 15:2782 (R;US)
Composite ceramic superconducting wires for electric-motor applications. Annual report No. 1, 30 June 1988-30 June 1989, 15:3117 (R;US)
Dispersion and rheology in ceramic processing, 15:2942 (BA;US)
High-temperature ceramic superconductors. Annual technical report, 24 May 1988-30 June 1989, 15:2899 (R;US)
Microwave cavity studies for thermal testing of ceramic breeder materials, 15:2944 (BA;US)
Nanophase materials assembled from atomic clusters, 15:2824 (R;US)
Numerical and empirical verification of the stress state in a ceramic, button-head, tensile specimen, 15:2913 (R;US)
Physics and materials science of high-temperature superconductors. Final report, 15:3121 (R;US)
Process monitoring using optical ultrasonic wave detection, 15:2915 (R;US)
Sialon ceramics. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989, 15:2933 (R;US)
Solid lubrication of ceramic sufraces by IAD [ion-assisted deposition]-silver coatings for heat engine applications, 15:2906 (R;US)

CERAMICS INDUSTRY
Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey, 15:3456 (R;US)

CEREALS
See also MAIZE
Food and grain preservation through irradiation. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 15:3688 (R;US)

CERIUM
Photoemission study of formation and oxidation of a cerium-copper interface, 15:2891 (J;US)

CERIUM SULFIDES
Thermophysical properties of the lanthanide sesquisulfides. I. Schottky functions and magnetic and electronic properties of γ-La_2S_3, γ-Ce_2S_3, γ-Nd_2S_3, and γ-Gd_2S_3, 15:3021 (J;US)

CESIUM 137
Ingestion of radiocesium and strontium-90 by self-suppliers and non-self-suppliers in the first year following the Chernobyl reactor accident. Data taken as a basis for derivation of secondary intervention reference levels, 15:3502 (R;DE;In German)
Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report, 15:3506 (R;DE;In German)
Radionuclide deposition and exposure in the Federal Republic of Germany after the Chernobyl accident, 15:3746 (R;US)

CESIUM ALLOYS
Structural properties of liquid alkali-metal–lead alloys: NaPb, KPb, RbPb, and CsPb, 15:2887 (J;US)

CHALKS
See LIMESTONE

CHARGE-COUPLED DEVICES
Use of a charge-coupled device camera for broadband coherent anti-Stokes Raman scattering measurements, 15:3377 (J;US)

CHARGED PARTICLES
See also DEUTERONS
Electrostatic precipitation of charged particles from a turbulent flow between coaxial cylinders, 15:3402 (R;US)
On the interactions of charged particles with cosmic string, 15:3987 (R;XA)

CHARGED-PARTICLE ACTIVATION
See ACTIVATION ANALYSIS
CHARGED PARTICLES

CHARM PARTICLES
Proceedings of the tau-charm factory workshop: Study of tau, charm and J/psi physics; development of high luminosity esup +esup minus rings; design of esup +esup minus detectors for tau-charm physics, 15:3962 (R;US)

CHARTS
See DIAGRAMS

CHEMICAL ANALYSIS
See also ACTIVATION ANALYSIS
QUANTITATIVE CHEMICAL ANALYSIS
Polarization spectroscopy in analytical measurements, 15:3067 (J;US)

CHEMICAL EXPLOSIONS
Dynamically compressed metals - theory. Final report, 1 February 1986-30 April 1989, 15:4200 (R;US)

CHEMICAL EXPLOSIVES
See also PETN
TATB
Burning rates of two cast nitramine explosives using a hybrid closed bomb-strand burner, 15:3382 (R;US)
Fast transit gas- and condensed-phase chemistry of energetic materials, 15:3381 (R;US)
Simultaneous thermal analysis techniques for characterization of energetic materials, 15:3380 (R;US)

CHEMICAL FEEDSTOCKS
Greenhouse gas emission coefficients from the energy system. Two methods to calculate national CO_2-e issions, 15:2599 (B;NL)

CHEMICAL INDUSTRY
Membrane separation processes for liquid hydrocarbons and gases in the petrochemical industry: A technical case study, 15:2118 (R;US)
Source characterization and control technology assessment of methylene chloride emissions from Eastman Kodak Company, Rochester, NY. Final report, July 1988-April 1989, 15:3452 (R;US)
Wastewater treatment: Chemical industry. January 1970-September 1989 (Citations from Pollution Abstracts). Report for January 1970-September 1989, 15:3563 (R;US)

CHEMICAL LASERS
Coupled multiline c-w (continuous-wave) HF (hydrogen fluoride) lasers: Experimental performance. Technical report, 15:3149 (R;US)
Design and operation of high efficiency electron-beam-initiated chemical lasers, 15:3171 (BA;US)
Multiline multimode c-w (continuous-wave) chemical laser performance. Technical report, 15:3142 (R;US)

CHEMICAL MUTAGENS
See MUTAGENS

CHEMICAL REACTION KINETICS
See also COMBUSTION KINETICS
A semiclassical tunneling model for use in classical trajectory simulations, 15:3086 (J;US)
Characterization of an experimental strange attractor by periodic orbits, 15:4298 (J;US)

Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)

CHEMICAL REACTIONS
See also CHEMISORPTION
CORROSION
FISCHER-TROPSCH SYNTHESIS
Determination of thermodynamic data for modeling corrosion: Volume 1, Sulfates (Revision 1): Final report, 15:2443 (R;US)
Quantum mechanical reactive scattering theory for simple chemical reactions: Recent developments in methodology and applications, 15:3077 (R;US)
Some new theoretical methods for treating reaction dynamics in polyatomic molecular systems, 15:3079 (R;US)
Theoretical methods for the study of chemical dynamics, 15:3078 (R;US)

CHEMICAL REACTORS
Slurry reactor hydrodynamics studies: Final report, 15:2261 (R;US)

CHEMICAL SPILLS
Methods used in the United States for the assessment and management of health risk due to chemicals, 15:3773 (R;US)

CHEMICAL WASTES
Best demonstrated available technology (BDAT) background document for K009 and K010, 15:2768 (R;US)
Best demonstrated available technology (BDAT) background document for phthalate wastes, 15:2767 (R;US)

CHEMISORPTION
Analysis of a diffusion-limited island growth mechanism for chemisorption and epitaxy, 15:3083 (J;US)
On the topic of single and multicomponent chemisorption isotherms, 15:2092 (R;US)

CHERENKOV COUNTERS
Development of an electron spectrometer for the HELIOS heavy ion experiment at CERN, 15:3346 (RA;DE;In German)

CHERENKOV DETECTORS
See CHERENKOV COUNTERS

CHERNOBYLSK-4 REACTOR
Analysis of fluid-structure interaction and structural response of Chernobyl-4 reactor, 15:2503 (R;US)
Radionuclide deposition and exposure in the Federal Republic of Germany after the Chernobyl accident, 15:3746 (R;US)

CHEST
Technique for chest radiography for pneumoconiosis, 15:3678 (R;US)

CHINA
Sources of methane in China: A program to estimate the emissions from rice paddies, biogas pits and urban areas: Annual progress report, 15:3411 (R;US)

CHINESE BEAN OIL
See SOYBEAN OIL

CHINESE HAMSTER OVARY CELLS
See CHO CELLS

CHIRAL SYMMETRY
Chiral symmetry restoration and quasi-elastic electron-nucleus scattering, 15:4019 (R;US)

CHLOR-ALKALI INDUSTRY
See CHEMICAL INDUSTRY
CHLORINE

CHLORINATED ALICYCLIC HYDROCARBONS
Optically based potassium sensor, 15:3372 (R;US)

CHLORINATED ALIPHATIC HYDROCARBONS
See also CHLOROFORM
PVC
Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:2772 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:2773 (R;US)
In-situ aquifer restoration of chlorinated aliphatics by methanotrophic bacteria. Research report, 1 May 1985-30 April 1989, 15:3554 (R;US)
Superfund Record of Decision (EPA Region 3): Croyden TCE Spill, PA. (First Remedial Action), December 1988, 15:3586 (R;US)

CHLORINATED AROMATIC HYDROCARBONS
Accumulation patterns of heavy metals and chlorinated hydrocarbons by sea otters, Enhydra lutris, in California. Final report, 15:3788 (R;US)
International aspects of restrictions of ozone-depleting substances, 15:3462 (R;US)
PCBs in humans: What we know and what we don't know, 15:3759 (R;US)
Toxicological profile for selected PCBs (polychlorinated biphenyls) (Aroclor-1260, -1254, -1248, -1242, -1232, -1221, and -1016). Final report, 15:3785 (R;US)

CHLORINATION
Case-control study of bladder cancer in Massachusetts among populations receiving chlorinated and chloraminated drinking water, 15:3771 (R;US)

CHLORINE
Chlorine related degradation of materials in coal liquefaction, 15:2018 (R;US)
Quantum state-resolved study of pure rotational excitation of CO_2 by hot atoms, 15:3933 (J;US)
The TVA moving-manifold targeted-chlorination system: Second field demonstration: Final report, 15:2413 (R;US)

CHLORINE CHLORIDES
See CHLORINE

CHLORINE COMPLEXES
A three-dimensional L^2 simulation of the photodetachment spectra of $ClHCl^-$ and IHI^-, 15:3100 (J;US)

CHLORINE IONS
Direct and resonance contributions to electron-impact excitation of n=2 to n=3 transitions in neonlike ions, 15:3907 (J;US)

CHLOROFORM
Best demonstrated available technology (BDAT) background document for K009 and K010, 15:2768 (R;US)

CHO CELLS
Radiobiology of ultrasoft X rays. IV. Flat and round-shaped hamster cells (CHO-10B, HS-23), 15:3754 (J;US)

CHROMATID DELETIONS
See CHROMOSOMAL ABERRATIONS

CHROMIUM
Aspects of faceting in the study of percipitate interfaces, 15:2841 (R;US)
Biosorption of molybdenum and chromium, 15:3546 (R;US)
Effect of chromium on properties of Fe_3Al, 15:2874 (J;US)

CHROMIUM 50
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

CHROMIUM 52
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

CHROMIUM 54
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

CHROMIUM ALLOYS
See also ALLOY-FE46NI33CR21
ALLOY-NI59CR30FE9
ALLOY-NI76CR15FE8
HAYNES 188 ALLOY
Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)

CHROMIUM OXIDES
Creep of chromia and yttria-doped chromia, 15:2902 (R;US)
Glancing angle x-ray studies of oxide films: Revision, 15:2903 (R;US)

CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS

CHROMOSOMAL ABERRATIONS
See also SISTER CHROMATID EXCHANGES
Radiation physics, biophysics, and radiation biology: Progress report, December 1, 1988–November 30, 1989, 15:3694 (R;US)

CHROMOSOME ABERRATIONS
See CHROMOSOMAL ABERRATIONS

CHROMOSOME EXCHANGES
See CHROMOSOMAL ABERRATIONS
CHROMOSOME FRAGMENTS
See CHROMOSOMAL ABERRATIONS
CIRCUIT BREAKERS
Power circuit breaker test system, 15:2419 (R;US)
CIRCULATING SYSTEMS
Development of high-efficiency molten carbonate fuel cell. Evaluation of stack performance and clarification of degradation mechanism at high fuel utilization, 15:2656 (R;JP;In Japanese)
CIRCULATION (BLOOD)
See BLOOD CIRCULATION
CISTRONS
See GENES
CITIES
See URBAN AREAS
CIVIL DEFENSE
Volunteering for emergency preparedness. Final report, March 1988-March 1989, 15:4550 (R;US)
CLAYS
See also BENTONITE
Structural studies of pillared clays and modified pillared clays, 15:2992 (BA;US)
CLEAN AIR ACT
BACT/LAER (Best Available Control Technology/Lowest Achievable Emission Rate) Clearinghouse: A compilation of control-technology determinations. Fourth supplement to 1985 edition. Summary tables and appendices A-H, 15:3491 (R;US)
CLEAN WATER ACT
Water pollution: More EPA action needed to improve the quality of heavily polluted waters, 15:3547 (R;US)
CLIMATE MODELS
Comparison of GCM and energy balance model simulations of seasonal temperature changes over the past 18 000 years, 15:3399 (J;US)
Seasonal climatic changes induced by doubled CO_2 as simulated by the OSU atmospheric GCM/mixed-layer ocean model, 15:3471 (J;US)
CLIMATES
Climate change and its effect on wet-removal processes, 15:3395 (B;US)
Ozone and other issues in global atmospheric chemistry, 15:3394 (B;US)
CLINTON P. ANDERSON MESON PHYSICS FACILITY
See LAMPF LINAC
CLOSED PLASMA DEVICES
See also COMPACT TORUS
HELIOTRON
STELLARATORS
TOKAMAK DEVICES
Bootstrap currents in toroidal systems, 15:4336 (RA;JP)
CNEN BRAZIL
See BRAZILIAN CNEN
CO-GENERATION
See COGENERATION
COAL
See also BLACK COAL
BROWN COAL
SUBBITUMINOUS COAL
Agglomeration
Coal surface control for advanced physical fine coal cleaning technologies: Quarterly report, May 1–July 31, 1989, 15:2015 (R;US)
Ash Content
Apparatus for direct measurement of ash fusion and sintering behavior at elevated temperatures and pressures, 15:2066 (J;US)
Chemical Reactions
[Coal science]: Foreign trip report, October 20, 1989–October 31, 1989, 15:2065 (R;US)
Cleaning
[Advanced physical fine coal cleaning: Froth flotation]: Quarterly technical progress report, July 1, 1989–September 30, 1989, 15:2016 (R;US)
Combustion
Coal-fueled diesel systems research: Volume 1, Basic fuel, fuel system, and combustion studies: Final report, 15:2798 (R;US)
Coal-fueled diesel systems research: Volume 2, Engine operation, durability and economic: Final report, 15:2799 (R;US)
Mineral matter transformations and slagging in a semi-industrial furnace, 15:2100 (R;NL)
[Analysis of acid rain and associated phenomena]: Final report, 15:2077 (R;US)
Combustion Products
Environmental aspects of coal-fueled diesel engines, 15:2080 (BA;US)
In-situ measurements of coal ash deposit optical properties: Final report, September 11, 1987–September 30, 1989, 15:2096 (R;US)
Laser diagnostics of mineral matter and combustion processes in coal: Research report, September 1, 1988–January 31, 1989, 15:2097 (R;US)
Combustion Properties
Apparatus for direct measurement of ash fusion and sintering behavior at elevated temperatures and pressures, 15:2066 (J;US)
Combustors
[US Agency for International Development–Government of India collaborative coal projects]: Foreign trip report, October 21, 1989–November 2, 1989, 15:2429 (R;US)
Compiled Data
International energy annual, 1988, 15:2630 (R;US)
Coprocessing
An investigation of coal-oil reaction pathways using model compounds, 15:2049 (B;US)
Inhibition of retrogressive reactions in coal/petroleum coprocessing: Quarterly technical progress report, June 1, 1989–August 31, 1989, 15:2025 (R;US)
Process and analytical studies of enhanced low severity coprocessing using selective coal pretreatment: Quarterly technical progress report, June–August, 1989, 15:2022 (R;US)
Synthetic fuels from coal-heavy oil mixtures. Phase 1. A survey of the work applicable to coal bitumen mixtures as synthetic fuels feedstock, 15:2027 (R;CA)
Devolatilization
An engineering model for coal devolatilization: Quarterly report, March 15, 1989–June 15, 1989, 15:2098 (R;US)
Exports
The directory of US coal and technology export resources, 15:2102 (R;US)
Flocculation
A new approach in ultrapurification of coal by selective flocculation: Annual report, 15:2024 (R;US)
Flotation
Column flotation of coal with fluorosurfactants: Final report, 15:2014 (R;US)
Hydrogenation
Electrochemical characterization and derivatization of coal: Final technical report, September 15, 1986–September 14, 1989, 15:2059 (R;US)
Mass Spectra
Numerical comparisons between the pyrolysis mass spectra of twelve US coals and their relative solubility in microbial cultures or alkaline buffer, 15:2062 (R;US)
Molecular Structure
[Coal structure and basic reactions]: Foreign trip report, October 20, 1989–October 28, 1989, 15:2064 (R;US)
Nmr Spectra
A solid-state NMR study of condensation/retrograde reactions during coal liquefaction: Quarterly progress report, July 1–September 30, 1989, 15:2023 (R;US)
Oxidation
Characterization of oxidized coal surfaces: Final report, 15:2061 (R;US)
Porosity
Role of porosity in supercritical fluid extraction of coal: Final technical report, 15:2060 (R;US)

Reactivity
High-sulfur coal research at the SIUC [Southern Illinois University at Carbondale] Coal Technology Laboratory: Quarterly progress report, July 1–September 30, 1989, 15:2058 (R;US)
Shape
A study of coal particle shape and three-body wear: Quarterly report, August–October 1989, 15:2057 (R;US)
Solubility
Numerical comparisons between the pyrolysis mass spectra of twelve US coals and their relative solubility in microbial cultures or alkaline buffer, 15:2062 (R;US)
Supercritical fluid thermodynamics for coal processing: Quarterly progress report, July 1, 1989–September 30, 1989, 15:2055 (R;US)
Spectroscopy
A solid-state NMR study of condensation/retrograde reactions during coal liquefaction: Quarterly progress report, July 1–September 30, 1989, 15:2023 (R;US)
Surface Properties
Enhancement of surface properties for coal benefication: Progress report, August 1, 1989–September 30, 1989, 15:2056 (R;US)
Wear
A study of coal particle shape and three-body wear: Quarterly report, August–October 1989, 15:2057 (R;US)

COAL DEPOSITS
Technical and economic factors influencing the exploration of black-coal deposits in developing countries, 15:2081 (RA;DE;In German)

COAL FINES
Review on mineral matter transformations and slagging in pulverized coal combustion, 15:2099 (R;NL)
The effect of system parameters on fines generation in limestone/coal char mixtures, 15:2048 (B;US)

COAL GASIFICATION
See also DOW GASIFICATION PROCESS
KRW GASIFICATION PROCESS
Apparatus for direct measurement of ash fusion and sintering behavior at elevated temperatures and pressures, 15:2066 (J;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual report. Report for 1 April 1988-31 March 1989, 15:2043 (R;US)
Coal Tar
Bench-scale fixation of soils from the Tacoma Tar Pits Superfund Site. Final report, 15:3521 (R;US)
Combined-Cycle Power Plants
Cool Water Coal Gasification Program: Environmental Monitoring Plan. Volume 1-5, Section 1-12, Appendices A-F. Report for 1984-89, 15:2045 (R;US)
Cool Water Coal Gasification Program: Environmental monitoring plan. Final Report, non-proprietary. Executive summary. Report for 1984-1989, 15:2046 (R;US)
Dow Gasification Process
Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1987. Report for 1 January-31 December 1987, 15:2039 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1987. Report for 1 January-31 March 1987, 15:2035 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1986. Report for 1 January-31 March 1986, 15:2031 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1986. Report for 1 October-31 December 1986, 15:2034 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2042 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1987. Report for 1 October-31 December 1987, 15:2038 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1986. Report for 1 April-30 June 1986, 15:2032 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1987. Report for 1 April-30 June 1987, 15:2036 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1988. Report for 1 April-30 June 1988, 15:2040 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1989. Report for 1 April-30 June 1989, 15:2044 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1986. Report for 1 July-30 September 1986, 15:2033 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1988. Report for 1 July-30 September 1988, 15:2041 (R;US)
Environmental Monitoring plan for the Dow Syngas Project. Quarterly report: Third quarter, 1987. Report for 1 July-30 September 1987, 15:2037 (R;US)
High Btu Gas
Advanced gasifier-desulfurizer process development for SNG (substitute natural gas) application. Final report, August 1987-December 1988, 15:2047 (R;US)
Research Programs
Review of physical science research, 1979-1988, 15:2136 (R;US)
Stretford Process
Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report, 15:2143 (R;US)

COAL LIQUEFACTION
A solid-state NMR study of condensation/retrograde reactions during coal liquefaction: Quarterly progress report, July 1–September 30, 1989, 15:2023 (R;US)
Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 8, June 15, 1989–September 15, 1989, 15:2021 (R;US)
Enhanced coal liquefaction by low-severity catalytic reactions: Final report, 15:2026 (R;US)
Kinetics of coal conversion to soluble products: January 1, 1989–June 30, 1989, 15:2019 (R;US)
Kinetics of coal conversion to soluble products: Quarterly report, July 1, 1989–September 30, 1989, 15:2020 (R;US)

COAL LIQUEFACTION PLANTS
Chlorine related degradation of materials in coal liquefaction, 15:2018 (R;US)

COAL LIQUIDS
Prediction of thermodynamic properties of coal derivatives: Progress report, March 1, 1989–February 28, 1990, 15:2054 (R;US)

COAL MINES
Use of foaming mud cement to terminate underground coal fires and to control subsidence of burn cavities. Final report, 15:2091 (R;US)

COAL MINING
Basic investigation of mixtures consisting of binders and tailings from coal mining with regard to their applicability as building materials in the mining industry, 15:2072 (R;DE;In German)
Methane drainage from gassy Western US coal seams, 15:2083 (R;US)
Shaping of working conditions for handicapped persons according to results of human-engineering research in hardcoal mining - main phase. Final report, 15:2103 (R;DE;In German)

COAL PREPARATION
High-sulfur coal research at the SIUC [Southern Illinois University at Carbondale] Coal Technology Laboratory: Quarterly progress report, July 1–September 30, 1989, 15:2058 (R;US)
The development of clean coal technology in the United States, 15:2013 (R;US)

COAL TAR
Bench-scale fixation of soils from the Tacoma Tar Pits Superfund Site. Final report, 15:3521 (R;US)

COAL-DERIVED LIQUIDS
See COAL LIQUIDS

COAL-OIL MIXTURES
See COAL
FUEL SLURRIES

COALIFICATION
Isotope labeling investigations in simulated coalification: A view of geological metamorphism, 15:2052 (R;US)

COASTAL REGIONS
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report, 15:3573 (R;US)
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report, 15:3574 (R;US)
Current and suspended sediment measurements on the central California continental shelf, 15:3819 (R;US)
Effects of wind and Gulf Stream events on the currents off the coast of North Carolina as it relates to oil-spill risk potential, 15:2128 (R;US)

COASTAL WATERS
Current measurement studies around the Cesme Peninsula (Turkey), 15:3569 (R;XA)

COBALT
Amorphous phase formation by solid-state reaction between polycrystalline Co thin films and single-crystal GaAs, 15:3014 (J;US)
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 2, 15:2262 (R;US)

COBALT 59
Investigation of monoenergetic pair conversion, 15:3344 (RA;DE;In German)

COBALT 60
Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report, 15:3506 (R;DE;In German)
Treatment planning for stereotactic heavy-charged particle radiosurgery of the brain, 15:3677 (R;US)

COBALT COMPOUNDS
See also COBALT SILICIDES
Amorphous phase formation by solid-state reaction between polycrystalline Co thin films and single-crystal GaAs, 15:3014 (J;US)

COBALT IONS
Analytical use of zide ion. Chemical equilibrium studies and correlates in $U(VI)/N_3$ and $Co(III)/N_3$ systems, 15:3047 (R;BR;In Portuguese)
Electron paramagnetic resonance investigations of divalent cobalt in single crystals of perovskite ($CaTiO_3$), 15:3023 (J;US)

COBALT SILICIDES
Silicide structural evolution in high-dose cobalt-implanted Si(100) crystals, 15:3028 (J;US)

COGENERATION
Cogeneration- and Total Energy potentials at an alternative natural gas price policy and environmental policy in the Dutch National Energy Outlook scenarios, 15:2619 (B;NL;In (In Dutch))
Commercial building research workshop. July 30-31, 1986, 15:2145 (R;US)
Regional application of natural-gas-fired combined-cycle power generation, 15:2759 (R;US)
Residential cogeneration system development. Annual interim report, February 1988-January 1989, 15:2777 (R;US)

COGENERATION PLANTS
See DUAL-PURPOSE POWER PLANTS

COHERENT RADIATION
Dephasing-induced coherences: higher-order selection rules and experiments in a magnetic field, 15:3901 (J;US)
Ultrahigh brightness XeCl laser system, 15:3170 (BA;US)

COILS (MAGNETIC)
See MAGNET COILS

COKE
Investigation of the formation and chemical aspects of coke deposits occurring on acid, monofunctional zeolite catalysts through typical reactions with hydrocarbons, 15:2270 (R;DE;In German)

COKE OVENS
Detailed control technology survey of a coke-oven plant, 15:2050 (R;US)

COKING
Production of coke with specific metallurgical properties. Analysis of conditions in the blast furnace, 15:2029 (R;DE;In German)

COLD PLASMA
Electron plasma interactions in crossed fields, 15:4361 (BA;US)
Study of a plasma edge cathode scheme for electron beam extraction, 15:4365 (BA;US)

COLLECTIVE MODEL
Breaking of separability condition for dynamical collective subspace. Onset of quantum chaos in large-amplitude collective motion, 15:4152 (R;JP)
Dissipation mechanism of the large-amplitude collective motion. Dynamical evolution of a collective bundle of trajectories in the TDHF phase space for a simple soluble model, 15:4155 (R;JP)

COLLEGES
See EDUCATIONAL FACILITIES

COLLIDING BEAMS
General properties of an asymmetric B-factory lattice, 15:3273 (R;US)

COLLIERIES
See COAL MINES

COLLISIONLESS PLASMA
Structure of slow magnetosonic shocks in low beta plasmas, 15:4371 (J;US)

COLLOIDS
See also ALGINIC ACID
EMULSIONS
FOAMS
Analytic solution of pseudocolloid migration in fractured rock, 15:2212 (R;US)
Field-flow fractionation in the analysis of energy-related materials: Final report, April 1, 1986–March 31, 1989, 15:3545 (R;US)

COLONIES
See POPULATIONS

COLORIMETRY
See ABSORPTION SPECTROSCOPY

COLUMBIA RIVER
Columbia River situation: A semi-technical review, 15:3548 (R;US)

COLUMBIUM
See NIOBIUM

COLUMNS (MECHANICAL)
See MECHANICAL STRUCTURES

COMANCHE PEAK-1 REACTOR
Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446): Supplement, 15:3594 (R;US)

COMANCHE PEAK-2 REACTOR
Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446): Supplement, 15:3594 (R;US)

COMBINED CYCLES
Regional application of natural-gas-fired combined-cycle power generation, 15:2759 (R;US)

COMBINED GAS AND STEAM CYCLE POWER PLANTS
See COMBINED-CYCLE POWER PLANTS

COMBINED STEAM-POWER GENERATION
See COGENERATION

COMBINED-CYCLE POWER PLANTS
Cool Water Coal Gasification Program: Environmental Monitoring Plan. Volume 1-5, Section 1-12, Appendices A-F. Report for 1984-89, 15:2045 (R;US)
Cool Water Coal Gasification Program: Environmental monitoring plan. Final Report, non-proprietary. Executive summary. Report for 1984-1989, 15:2046 (R;US)

COMBUSTION
See also FLUIDIZED-BED COMBUSTION
PULSE COMBUSTION

Kinetics data base for combustion modeling: Status report, February 1, 1988–January 31, 1989, 15:3107 (R;US)
Molecular beam studies of oxygen atom reactions with unsaturated hydrocarbons, 15:3109 (R;US)
Note on improved k-ε turbulent flow model, 15:3111 (RA;DK;In Danish)
Peat - Environment - Society. Part 2: Emissions from combustion of peat, 15:2073 (R;FI;In Finnish)
Qualitative modeling and control of combustion, 15:3251 (R;FI;In Finnish)
Review on mineral matter transformations and slagging in pulverized coal combustion, 15:2099 (R;NL)
Sonic pyrometry in furnaces. Fundamentals, 15:3253 (R;FI;In Finnish)

COMBUSTION CHAMBERS
Aerothermal modeling program. Phase 2, element A: improved numerical methods for turbulent viscous recirculating flows, 15:3196 (RA;US)
Application of advanced diagnostics to airblast injector flows, 15:3198 (RA;US)
Constitutive modeling for isotropic materials, 15:3243 (RA;US)
Creep fatigue life prediction for engine hot section materials (ISOTROPIC) fifth year progress review, 15:3247 (RA;US)
Elevated temperature crack growth, 15:3246 (RA;US)
Finite element implementation of viscoplastic models, 15:3244 (RA;US)
Mechanics of materials model, 15:3240 (RA;US)
Qualitative modeling and control of combustion, 15:3251 (R;FI;In Finnish)
Structural response of an advanced combustor liner: Test and analysis, 15:3245 (RA;US)
Three-dimensional inelastic analysis methods for hot section components, 15:3237 (RA;US)
Three-dimensional inelastic analysis methods for hot section components, 15:3242 (RA;US)
Turbine Engine Hot Section Technology, 1987, 15:3236 (R;US)

COMBUSTION KINETICS
A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation, 15:2541 (R;US)

COMBUSTION PRODUCTS
Caterpillar 3406 spark-ignited natural-gas-engine emissions on EPA (Environmental Protection Agency) heavy-duty transient test cycle. Topical report, March-December 1988, 15:2801 (R;US)
Laser-induced-fluorescence spectroscopy of jet-cooled C_3, 15:3116 (J;US)
Measurements of gas concentrations and temperature in a boiler room, 15:2428 (R;DK;In Danish)
Mutagenicity of combustion emissions from a biomedical-waste incinerator, 15:3774 (R;US)
Recent developments of emission control technology in the United States for fossil fuel combustion sources, 15:3249 (R;US)

COMBUSTION WAVES
Evolution of reaction center in an explosive material, 15:3106 (R;US)

COMBUSTORS
See also CATALYTIC COMBUSTORS
FLUIDIZED-BED COMBUSTORS
Heat transfer, 15:2805 (B;US)
MHD [Magnetohydrodynamics] Integrated Topping Cycle Project: Fourth quarterly technical progress report, May 1, 1988–July 31, 1988, 15:2649 (R;US)

COMETS
See also HALLEY COMET
CoMA, an instrument for the detailed in-situ analysis of collected cometary particulates, 15:3348 (RA;DE;In German)

COMMERCE
See TRADE

COMMERCIAL BUILDINGS
Commercial building research workshop. July 30-31, 1986, 15:2145 (R;US)
Evaluation of the energy conservation program for the NMB bank offices, 15:2677 (R;NL;In (In Dutch))
Evaluation of the energy conservation program for the NMB bank offices. Appendices and figures, 15:2678 (R;NL;In (In Dutch))

COMMERCIALIZATION
Development of solar collector modules, 15:2347 (R;DK;In Danish)

COMMUNICATIONS
Business communications, 15:4536 (R;US)
ELF (extremely low frequency) communications system ecological monitoring program: Electromagnetic field measurements and engineering support – 1988. Technical report, 1982-1988, 15:3795 (R;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 7. Part A. Time oriented problem solving. Interim report, December 1986-December 1987, 15:4499 (R;US)

COMMUNITIES (ECOLOGICAL)
See ECOSYSTEMS

COMPACT IGNITION TOKAMAK
Critical safety function guidelines for experimental fusion facilities, 15:4405 (R;US)
Design process for the CIT (compact ignition tokamak) poloidal field coil system, 15:4474 (BA;US)
Ring coil optimization with respect to stress, temperature, and system energy over a range of physics requirements, 15:4471 (BA;US)

COMPACT TORUS
Reflection of accelerated plasma rings from conical electrodes in the RACE experiment, 15:4368 (BA;US)

COMPARATIVE EVALUATIONS
Predicting flow through low-permeability, partially saturated, fractured rock: A review of modeling and experimental efforts at Yucca Mountain, 15:2234 (R;US)

COMPLEX TERRAIN
Integration of fluid modeling with complex-terrain field studies and model-development efforts, 15:3449 (R;US)

COMPLEXES
See also CHLORINE COMPLEXES
IODINE COMPLEXES
RARE EARTH COMPLEXES
Direct insertion of metal ions into tetrasulfonated phthalocyanine, 15:3071 (R;US)
Transition metal complexes as sensitizers or protectors against $O_2 \cdot^-$ toxicity, 15:3700 (RA;DE)

COMPOSITE MATERIALS
Challenges in processing for polymer composites, 15:2988 (R;US)
Computational simulation of high temperature metal matrix composites cyclic behavior, 15:2976 (R;US)
Fatigue crack growth study of SCS6/Ti-15-3 composite, 15:2974 (R;US)
Fracture-toughness testing of metal-matrix composites, 15:2966 (R;US)
Optimum interface properties for metal matrix composites, 15:2975 (R;US)
Protective coating for alumina-silicon carbide whisker composites, 15:3037 (P;US)
Research and technology plans for FY 1989 and accomplishments for FY 1988, 15:2977 (R;US)
Use of ash in highway construction: Delaware demonstration project: Final report, 15:2069 (R;US)
Y-Si-Al-O-N glass fibers. Final report, 15:2967 (R;US)
[Graphite and carbon/carbon composition]: Foreign trip report, September 17, 1988–September 28, 1988, 15:2979 (R;US)

COMPOUND NUCLEI
Binary complex fragment emission and multifragmentation from very hot nuclei, 15:4099 (R;US)

COMPOUND PARABOLIC CONCENTRATORS
Optical properties of one and two-stage concentrator systems with non-paraboloidal and non-axisymmetric primaries, 15:2348 (BA;US)

COMPOUND-NUCLEUS REACTIONS
Compound elastic enhancement, 15:4146 (RA;DE)
Sensitivity of the fluctuating cross-section to time-reversal violation, 15:4144 (RA;DE)
The statistical theory of nuclear reactions in the limit of isolated resonances, 15:4148 (RA;DE)
Variance in the fluctuating cross-section, 15:4145 (RA;DE)

COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS

COMPRESSIBLE FLOW
Numerical simulation of the compressible Orszag-Tang vortex. Interim report, June 1988-February 1989, 15:3935 (R;US)
Survey of measurements and measuring techniques in rapidly distorted compressible turbulent boundary layers, 15:3185 (R;FR)

COMPRESSORS
Development of high-efficiency scroll compressors for air conditioners, 15:2695 (R;JP)

COMPUTED TOMOGRAPHY
See COMPUTERIZED TOMOGRAPHY

COMPUTER ARCHITECTURE
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 7. Part A. Time oriented problem solving. Interim report, December 1986-December 1987, 15:4499 (R;US)
Optimization algorithms for new computer architectures with applications to personnel-assignment models. Annual report (Final), 1 May 1988-30 April 1989, 15:4501 (R;US)
Rewrite Rule Machine project. Final report, 15:4500 (R;US)

COMPUTER CODES
See also A CODES
B CODES
F CODES
H CODES
L CODES
M CODES
N CODES
S CODES
T CODES
W CODES
Z CODES
Algorithms and programs for evaluating fault trees with multistate components, 15:4519 (R;DE;In German)
Comparison of a cavity solar receiver numerical model and experimental data, 15:2326 (BA;US)
Microwave cavity studies for thermal testing of ceramic breeder materials, 15:2944 (BA;US)
Model validation: Cooling-tower performance: Final report, 15:2415 (R;US)
Optical properties of one and two-stage concentrator systems with non-paraboloidal and non-axisymmetric primaries, 15:2348 (BA;US)
Ring coil optimization with respect to stress, temperature, and system energy over a range of physics requirements, 15:4471 (BA;US)
Simulation of energy consumption by taking thermal comfort into account, 15:2701 (R;NO)
The TITAN oscillating-field current-drive system, 15:4463 (BA;US)
VAWT dynamic stall models revisited, 15:2394 (BA;US)

COMPUTER NETWORKS
The Hazardous Materials Information Exchange: An electronic bulletin board for the emergency response community, 15:3494 (R;US)

COMPUTER PROGRAM DOCUMENTATION
UDEC (Universal Distinct Element Code) version ICG1.5: User's manual: Volume 2, 15:3816 (R;US)

COMPUTER PROGRAMS
See COMPUTER CODES

COMPUTER-AIDED DESIGN
Position of Sandia National Laboratories with respect to product definition standards, 15:4527 (R;US)

COMPUTER-AIDED INSTRUCTION
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
Research, development, training, and education using the Ada programming language. Final report, 1 September 1987-31 May 1989, 15:4503 (R;US)

COMPUTERIZED CONTROL SYSTEMS
Adaptive pitch control for power regulation of the MS-2 wind turbine, 15:2363 (R;GB)
Computer control of the tunnel barrier width for the scanning tunneling microscope, 15:3374 (J;US)

COMPUTERIZED TOMOGRAPHY
Computerized tomographic in non-destructive testing, 15:3334 (R;BR;In Portuguese)
Computerized tomography of spinal cord in contrasting, 15:3631 (RA;SU;In Russian)

COMPUTERS
Computer systems protection: Uninterruptible power supplies. January 1983-September 1989 (Citations from the Computer data base). Report for January 1983-September 1989, 15:4523 (R;US)

CONCANAVALIN
Relationship of free CoA and long-chain Acyl-CoA in liver of animals after whole-body gamma irradiation, 15:3742 (RA;SU;In Russian)

CONCENTRATOR SOLAR CELLS
High-efficiency silicon concentrator solar cells for use with prismatic covers, 15:2302 (R;US)

CONCRETES
Applicability of the DMSO (dimethyl sulfoxide) aggregate degradation test to determine moisture-induced distress in asphalt-concrete mixes. Final report, June 1986-June 1987, 15:2980 (R;US)
Frost resistance of concrete in artic offshore structures, 15:2755 (R;FI;In Finnish)
Service life of concrete, 15:2219 (R;US)

CONDENSERS
The TVA moving-manifold targeted-chlorination system: Second field demonstration: Final report, 15:2413 (R;US)

CONDENSERS (ELECTRIC)
See CAPACITORS

CONDITION RATIO
See FORMATION DAMAGE

CONFERENCES
See MEETINGS

CONFORMAL INVARIANCE
Fuchsian differential equations for characters on the torus: A classification, 15:4026 (J;NL)

CONFORMATIONAL CHANGES
Interactions of carcinogens with DNA [deoxyribonucleic acid]: Final progress report, July 1, 1987–July 31, 1989, 15:3760 (R;US)

CONSERVATION (ENERGY)
See ENERGY CONSERVATION

CONSERVATION (RESOURCE)
See RESOURCE CONSERVATION

CONSOLIDATED FUEL REPROCESSING PROGRAM
Results of the Manipulator Test Test Stand study: Comparison of manipulators and evaluation of equipment items, 15:2170 (R;US)

CONTACT RADIOTHERAPY
See RADIOTHERAPY

CONTAINERS
See also CASKS
PRESSURE VESSELS
REACTOR VESSELS

Development of a container for pumps, measuring equipment and motorgenerators in connection with a bioconversion energy system, 15:2297 (R;DK;In Danish)
Directory of certificates of compliance for radioactive materials packages: Report of NRC approved quality assurance programs for radioactive materials packages: Volume 3: Revision 9, 15:3132 (R;US)
Gas flow in and out of a nuclear waste container, 15:2211 (R;US)

CONTAMINATION
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)
Regulatory requirements for groundwater monitoring networks at hazardous waste sites, 15:3501 (R;US)
Use of the Multimedia Environmental Pollutant Assessment System (MEPAS) for large- and small-scale applications, 15:2229 (R;US)

CONTAMINATION (INTERNAL)
See RADIONUCLIDE KINETICS

CONTENT ANALYSIS
See CHEMICAL ANALYSIS

CONTINENTAL SHELF
Federal offshore statistics, 1987: Leasing exploration, production, and revenues, 15:2106 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2, 15:2130 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices, 15:2131 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 1. Final executive summary, 15:2129 (R;US)
Transport and transfer rates in the waters of the continental shelf and slope: SEEP: Triennial report, 1 May 1987–30 April 1990, 15:3817 (R;US)

CONTROL (RADIOACTIVITY)
See RADIATION MONITORING

CONTROL THEORY (REACTOR)
See REACTOR KINETICS

CONVECTION
See also NATURAL CONVECTION
Nonlinear RR Lyrae models with time dependent convection, 15:3872 (BA;US)

CONVENTIONAL WARFARE
Modeling casualties in nuclear warfare. Final report, 15:3385 (R;US)

COOLANT LOOPS
Design and testing of a superfluid liquid helium cooling loop, 15:3131 (R;US)

COOLERS
See HEAT EXCHANGERS

COOLING SYSTEM (REACTOR)
See REACTOR COOLING SYSTEMS

COOLING SYSTEMS
See also COOLANT LOOPS
REACTOR COOLING SYSTEMS
THERMONUCLEAR REACTOR COOLING SYSTEMS
A study of aggregation bias in estimating the market for home heating and cooling equipment, 15:2687 (R;US)
Desiccant cooling and dehumidification opportunities for buildings workshop, 15:2700 (R;US)
Horizontal cold source friction losses of D_2 model with coaxial tubes comparison of calculated values with experimental results in D_2, 15:2259 (TG;US)
Market share elasticities for fuel and technology choice in home heating and cooling, 15:2685 (R;US)
Operation and performance of commercial cool storage systems: Volume 1, 1987 cooling season, 15:2564 (R;US)

COOLING TOWERS
Model validation: Cooling-tower performance: Final report, 15:2415 (R;US)

COPOLYMERS
A new polymer-based hydrogen getter, 15:2993 (BA;US)

COPPER
A finite temperature theory of rotationally inelastic diffraction: H_2, HD, and D_2 on Cu(100), 15:4243 (J;US)
Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)
Laser-induced interface reactions of copper thin films on sapphire substrates, 15:2878 (J;US)
Nuclear spin relaxation of ^{12}B implanted in various metallic single crystals, 15:4228 (RA;DE;In German)
Photoemission study of formation and oxidation of a cerium-copper interface, 15:2891 (J;US)
Pretreatment and conditioning of storage ring vacuum systems, 15:3315 (R;US)
The biocorrosion of copper by biopolymers as examined in situ, in real time FT-IR/CIR/ATR in conjunction with pre and post XPS/AES, 15:2832 (R;US)
Thermodynamic properties of fcc transition metals as calculated with the embedded-atom method, 15:2883 (J;US)
Trajectory analysis of low-energy and hyperthermal ions scattered from Cu(110), 15:3887 (R;US)

COPPER 59
Shapes of ^{59}Cu nuclei at moderate excitation energies and spin, 15:4091 (J;US)

COPPER 63 TARGET
Deep-inelastic myon-nucleus scattering at the CERN SPS; EMC and NMC Collaboration, 15:3956 (RA;DE;In German)

COPPER ALLOYS
Formation of metastable structures and amorphous phases in Cu-W alloys using the triode sputtering technique, 15:2860 (BA;US)
Magnetic viscosity in Ni/Cu compositionally-modulated alloys, 15:2812 (R;US)
The dose, temperature, and projectile-mass dependence for irradiation-induced amorphization of CuTi, 15:2873 (J;US)
The projectile mass dependence of the amorphization process and the critical temperature in the ion irradiated CuTi, 15:2858 (BA;US)

COPPER COMPOUNDS
See also COPPER OXIDES
CUPRATES
Processing and fabrication of high-temperature oxide superconductors. Annual report, 1 August 1988-30 June 1989, 15:2897 (R;US)
Resistivity measurements of superconducting materials. Master's thesis, 15:2932 (R;PK)

COPPER OXIDES
Antiferromagnetism
Neutron-powder-diffraction study of the structure and antiferromagnetic ordering in Pr_2CuO_4, 15:3031 (J;US)
Chemical Preparation
Sulfur dioxide removal from flue gases by supported copper and iron absorbents: Final technical report, May 16, 1986-December 31, 1988, 15:2068 (R;US)
Critical Current
Dissipation measurement in high T_c superconductors with electromagnetic probes, 15:2916 (R;US)
Crystal Defects
Lattice defects and flux pinning in crystallized metal-oxide glasses in the Bi-Sr-Ca-Cu-O system, 15:2947 (J;US)
Crystal Lattices
Local atomic displacements in high T_c oxides studied by pulsed neutron scattering, 15:2905 (R;US)
Crystal Structure
Neutron-powder-diffraction study of the structure and antiferromagnetic ordering in Pr_2CuO_4, 15:3031 (J;US)
Diffusion
Anisotropy of oxygen tracer diffusion in $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:2914 (R;US)

Electric Conductivity
Microwave characterization of high-temperature superconductors, 15:2921 (R;US)

Electronic Structure
Electronic structure of $Pb_2Sr_2PrCu_3O_8$ as studied by resonant photoemission spectroscopy, 15:2956 (J;US)

Energy Gap
Break junction measurement of the tunneling gap of a thallium-based high-temperature superconductor crystal, 15:2950 (J;US)

Heat Treatments
Effect of heat treatment time and temperature of the properties of $YBa_2Cu_3O_{7-x}$, 15:2945 (J;US)

Ion Implantation
Ion implantation of sputtered Y-Ba-Cu-O films, 15:2951 (J;US)

Magnetic Flux
Lattice defects and flux pinning in crystallized metal-oxide glasses in the Bi-Sr-Ca-Cu-O system, 15:2947 (J;US)

Microstructure
Microstructures of Y123 films on $SrTiO_3$, $LaGaO_3$ and $LaAlO_3$, 15:2922 (R;US)

Muon Spin Relaxation
Magnetic ordering in $(Y_{1-x}Pr_x)Ba_2Cu_3O_7$ as evidenced by muon spin relaxation, 15:4256 (R;US)

Nmr Spectra
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)

Optical Properties
Ground-state and optical properties of Cu_2O and CuO crystals, 15:3032 (J;US)

Order Parameters
States of partial order in $YBa_2Cu_3O_z$, 15:2948 (J;US)

Order-Disorder Transformations
Lattice mode study of La_2CuO_{4-y} implanted with Sr, 15:2937 (BA;US)
Mean-field theory of oxygen-vacancy ordering in $YBa_2Cu_3O_{7-\delta}$, 15:2961 (J;US)

Processing
The effect of composition and processing on high T_c superconductors containing bismuth, 15:2909 (R;US)

Research Programs
Electronic materials high-T_c superconductivity polymers and composites structural materials surface science and catalysts industry participation: Annual report, 1988, 15:2923 (R;US)

Sputtering
Ion implantation of sputtered Y-Ba-Cu-O films, 15:2951 (J;US)

Superconductivity
Effects of oxygen and strontium vacancies on the superconductivity of single crystals of $Bi_2Sr_{2-x}CuO_{6-y}$, 15:2959 (J;US)
Exchange-driven pairing of delocalized carriers in high-temperature superconductors, 15:4260 (J;US)
The formation of metal-oxygen species at low temperatures, 15:4253 (R;US)
Variation of T_{c0} in the 110 K superconductor $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$, 15:2949 (J;US)
[Dynamics of magnetic fluctuations in high-T_c materials]: Foreign trip report, October 5–October 15, 1989, 15:4257 (R;US)

Transition Temperature
Effects of oxygen and strontium vacancies on the superconductivity of single crystals of $Bi_2Sr_{2-x}CuO_{6-y}$, 15:2959 (J;US)

Vacancies
Effects of oxygen and strontium vacancies on the superconductivity of single crystals of $Bi_2Sr_{2-x}CuO_{6-y}$, 15:2959 (J;US)
Mean-field theory of oxygen-vacancy ordering in $YBa_2Cu_3O_{7-\delta}$, 15:2961 (J;US)

COPPER VAPOR LASERS
See GAS LASERS

COPROCESSING
Synthetic fuels from coal-heavy oil mixtures. Phase 1. A survey of the work applicable to coal bitumen mixtures as synthetic fuels feedstock, 15:2027 (R;CA)

CORE FLOODING SYSTEMS
Critical investigations and model development on countercurrent flow of gas and liquid in horizontal and vertical channels. Final report, 15:2530 (R;DE;In German)

CORES (REACTOR)
See REACTOR CORES

CORN (MAIZE)
See MAIZE

CORN STOVER
See AGRICULTURAL WASTES
MAIZE

CORONA (SOLAR)
See SOLAR CORONA

CORPS OF ENGINEERS
Sediment-water interactions and contaminants in Corps of Engineers reservoir projects. Final report, 15:3543 (R;US)

CORROSION
Corrosion database for the nuclear fuel cycle. Sub-project no. 1. Final report, 15:4544 (R;DE;In German)

CORROSION INHIBITION
See CORROSION PROTECTION

CORROSION PROTECTION
Corrosion-resistant coatings. February 1983-September 1989 (Citations from the NTIS data base). Report for February 1983-September 1989, 15:2848 (R;US)

CORROSION RESISTANT ALLOYS
See also ALLOY-FE46NI33CR21
ALLOY-NI59CR30FE9
ALLOY-NI76CR15FE8
Chromium modified nickel-iron aluminide useful in sulfur bearing environments, 15:2896 (P;US)

COSMIC PARTICLES
See COSMIC RADIATION

COSMIC RADIATION
See also PRIMARY COSMIC RADIATION
Current models of the intensely ionizing particle environment in space, 15:3853 (RA;US)
Elemental composition and energy spectra of galactic cosmic rays, 15:3861 (RA;US)
Galactic cosmic rays in three dimensions, 15:3865 (RA;US)
Gradients of galactic cosmic rays and anomalous components, 15:3863 (RA;US)
Interplanetary particle environment. Proceedings of a conference, 15:3361 (R;US)
The anomalous cosmic-ray component, 15:3862 (RA;US)
The effects of high energy particles on planetary missions, 15:3362 (RA;US)
Time variation of galactic cosmic rays, 15:3864 (RA;US)
Toward a descriptive model of galactic cosmic rays in the heliosphere, 15:3852 (RA;US)

COSMIC RAY FLUX
Galactic cosmic rays in three dimensions, 15:3865 (RA;US)

COSMIC X-RAY SOURCES
Early phase of supernova remnant evolution, 15:3822 (RA;DE;In German)

COSMOGONY
See COSMOLOGY

COSMOLOGICAL MODELS
See also INFLATIONARY UNIVERSE
Bubble dynamics and spontaneous compactification, 15:3879 (J;US)

COSMOLOGY
Origin of the universe from Quantum Chaos: An introduction to current ideas (professor John Dyer Memorial Lecture). Technical report, 15:3820 (R;US)
Two-point correlation function of cosmic-string loops, 15:4054 (J;US)

COSMOS
See UNIVERSE

COUNTERFLOW COOLING TOWERS
See COOLING TOWERS

COUNTERS (RADIATION)
See RADIATION DETECTORS

COUNTING CIRCUITS
Nuclear physics electronics, 15:3342 (RA;DE;In German)
COUNTING TECHNIQUES
Collision-radiation recombination, 15:3345 (RA;DE;In German)
Investigation of monoenergetic pair conversion, 15:3344 (RA;DE;In German)
COUNTY BUILDINGS
See PUBLIC BUILDINGS
COURT BUILDINGS
See PUBLIC BUILDINGS
CPT THEOREM
Possible test of *CPT* invariance in neutral-kaon regeneration, 15:4028 (J;US)
CRANKING MODEL
Electromagnetic decay of hot rotating nuclei, 15:4150 (RA;DE)
CREEKS
See STREAMS
CREOSOTE
Evaluation of emission sources from creosote wood-treatment operations. Final report, 15:2747 (R;US)
CRITICAL CURRENT
Dissipation measurement in high T_c superconductors with electromagnetic probes, 15:2916 (R;US)
CRITICALITY ACCIDENTS
See RADIATION ACCIDENTS
CROSS-LINKING
Plastics and elastomers: Radiation crosslinking. April 1986-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for April 1986-September 1989, 15:2981 (R;US)
Protein-DNA-crosslinks induced by primary and secondary radicals, 15:3729 (RA;DE)
CROSSED BEAMS
See COLLIDING BEAMS
CROSSFLOW COOLING TOWERS
See COOLING TOWERS
CROWN ETHERS
See POLYETHYLENE GLYCOLS
CRUDE OIL
See PETROLEUM
CRUISE MISSILES
High-energy-density solid and liquid hydrocarbon fuels. Final report, July 1987-December 1988, 15:2120 (R;US)
CRYOGENICS
DIII-D cryogenic control system upgrade, 15:4411 (R;US)
CRYOPUMPS
Continuous cryopump with a method for removal of solidified gases, 15:3141 (P;US)
CRYOSTATS
Preliminary design of the CIT [Compact Ignition Tokamak] cryostat, 15:4394 (R;US)
CRYSTAL COUNTERS
Robust spatial calibration of a planar positron camera. Final report, October 1985-September 1987, 15:3614 (R;US)
CRYSTAL DEFECTS
Nuclear magnetic resonance imaging as a tool to characterize defect densities in solids, 15:4201 (R;US)
CRYSTAL LATTICES
Multithermodynamic phase lattice-gas automata incorporating interparticle potentials, 15:4296 (J;US)
CRYSTAL MODELS
Analytic embedded atom method model for bcc metals, 15:2876 (J;US)
CRYSTAL STRUCTURE
See also CRYSTAL DEFECTS
CRYSTAL LATTICES
MICROSTRUCTURE
Quasicrystals and grain boundaries, 15:2823 (R;US)
Variational quantum Monte Carlo calculation of electronic and structural properties of crystals, 15:4235 (R;US)
CRYSTALLOGRAPHY
Nuclear solid state physics and technology, 15:4227 (RA;DE;In German)
CRYSTALS
See also LIQUID CRYSTALS
MONOCRYSTALS
Acoustic studies of new materials: Quasi crystals, low-loss glasses, and high tc superconductors. Annual summary report, 1 October 1988-30 September 1989, 15:2901 (R;US)
Comment on "Speckle in the diffraction patterns of Hendricks-Teller and icosahedral glass models", 15:4241 (J;US)
Random-tiling quasicrystal, 15:4244 (J;US)
CUMULATIVE EFFECT
See PARTICLE PRODUCTION
CUPRATES
Processing and fabrication of high-temperature oxide superconductors. Annual report, 1 August 1988-30 June 1989, 15:2897 (R;US)
Resistivity measurements of superconducting materials. Master's thesis, 15:2932 (R;PK)
Variation of T_{c0} in the 110 K superconductor $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$, 15:2949 (J;US)
CURING
See also RADIATION CURING
Cure analysis of printed-circuit boards containing reactive adhesive layers, 15:3226 (R;US)
CURRENT-DRIVE HEATING
Proceedings of US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts, 15:4319 (R;JP)
CURRENTS (BEAM)
See BEAM CURRENTS
CURVES
See DIAGRAMS
CYANIDES
See also HYDROCYANIC ACID
Best demonstrated available technology (BDAT) background document for cyanide wastes, 15:2770 (R;US)
CYCLOALKENES
Dissociation of cyclohexene and 1,4-cyclohexadiene in a molecular beam, 15:3098 (J;US)
CYCLOTRON INSTABILITY
Particle simulation of Alfven/ion-cyclotron instabilities in a neutral-beam current-driven plasma, 15:4320 (RA;JP)
CYCLOTRONS
Cyclotron targetry for production of short-lived positron emitters, 15:3102 (R;US)
CYSTEINE
A process for the preparation of cysteine from cystine, 15:2076 (P;US)

D

D MESONS
Recent results on weak decays of charmed mesons from the Mark III experiment, 15:3967 (R;US)
D PLUS RESONANCES
See D MESONS
D* PLUS RESONANCES
See BARYONS
D* ZERO RESONANCES
See BARYONS
D*RESONANCES
See BARYONS
D-1865 RESONANCES
See D MESONS
DAMAGE
The ecology of riparian habitats of the southern California coastal region: A community profile, 15:3538 (R;US)
DAMAGE FACTOR
See FORMATION DAMAGE
DAMAGE RATIO
See FORMATION DAMAGE
DAMAGE ZONE
See FORMATION DAMAGE

DAMPERS (GAS FLOW)
See DRAFT CONTROL SYSTEMS
DATA
PLOTnFIT: A BASIC program for data plotting and curve fitting, 15:4522 (R;US)
DATA ACQUISITION SYSTEMS
Data file management in the DIII-D data acquisition and analysis computer systems, 15:4412 (R;US)
Electronics for online and data acquisition, 15:4517 (RA;DE;In German)
Status of the data acquisition system for the Crystal Ball, 15:3343 (RA;DE;In German)
Upgrade plans to handle 30 to 40 Mbytes of data for DIII-D, 15:4409 (R;US)
DATA BASE MANAGEMENT
Abbreviated query interpretation in extended entity-relationship oriented databases, 15:4542 (R;US)
Database in Japan 1989, 15:4538 (B;JP)
Event-join optimization in temporal relational databases, 15:4543 (R;US)
Kinetics data base for combustion modeling: Status report, February 1, 1988–January 31, 1989, 15:3107 (R;US)
Optimizing voting-type algorithms for replicated data, 15:4541 (R;US)
Power reactor embrittlement data base, 15:2510 (R;US)
DATA DISPLAY DEVICES
See DISPLAY DEVICES
DATA DISPLAY SYSTEMS
See DISPLAY DEVICES
DATA PROCESSING
Note on improved k-ε turbulent flow model, 15:3111 (RA;DK;In Danish)
DATA TRANSMISSION SYSTEMS
One-way transformation of information, 15:4549 (P;US)
Universal null DTE, 15:4534 (P;US)
DAUGHTER PRODUCTS
Indoor radon and radon-decay product measurement protocols, 15:3487 (R;US)
The microdosimetry of radon decay products in the respiratory tract, 15:3748 (R;US)
DAYGLOW
See AIRGLOW
DAYLIGHTING
Beyond the IDMY [International Daylighting Measurements Year]: A network instrument for low-cost data acquisition, 15:2699 (R;US)
DEACTIVATION
Investigation of the formation and chemical aspects of coke deposits occurring on acid, monofunctional zeolite catalysts through typical reactions with hydrocarbons, 15:2270 (R;DE;In German)
DEBRIS (NUCLEAR)
See FISSION PRODUCTS
DECAY PRODUCTS
See DAUGHTER PRODUCTS
DECISION MAKING
IDEA—Interactive Decision Analysis: Users' guide and tutorial, 15:4505 (R;US)
Standard Review Plan for a petition for rulemaking on radioactive waste streams below regulatory concern: Expedited review in accordance with Appendix B to 10 CFR, Part 2: Data report for comment, 15:2213 (R;US)
The problem of finding a strategy in control binary paramodulation, 15:4506 (R;US)
DECONTAMINATION
Radioactive waste storage sites: Reclamation and remedial action. January 1970-July 1989 (Citations from the NTIS data base). Report for January 1970-July 1989, 15:2221 (R;US)
Ultrasonic and immersion cleaning: a comparison using aqueous and fluorocarbon solvents, 15:2176 (R;GB)
DECONTAMINATION FACTOR
See DECONTAMINATION EFFICIENCY
DEFECTS
Non-destructive radiometry inspection technique for locating reinforcements and void/porosity in bridge bearings, 15:2257 (R;MY)
DEFENSE
See NATIONAL DEFENSE
DEFORMED NUCLEI
Deformed proximity potential for heavy ion reactions, 15:4123 (R;US)
Saturation effects in gamma-band energies, 15:4172 (J;US)
DEHUMIDIFIERS
Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems, 15:2340 (BA;US)
DEHYDRATORS
Diesel-driven heat pump applied to grain drying and chilling. Phase 2, 15:2734 (R;DK;In Danish)
DEHYDROGENASES
See OXIDOREDUCTASES
DELAYED RADIATION INJURIES
See RADIATION INJURIES
DELETIONS (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS
DELTA-966 RESONANCES
See A0-980 MESONS
DENMARK
Report on the Ministry of Energy's statement regarding subsection 2 of section 12 of act number 293 of 10th June 1981, on the utilization of Denmark's subterranean committee on 26th October 1988, 15:2139 (R;DK;In Danish)
DENSITY (ELECTRON)
See ELECTRON DENSITY
DEOXYPENTOSE NUCLEIC ACID
See DNA
DEOXYRIBONUCLEIC ACID
See DNA
DEPLETION (ISOTOPIC)
See ISOTOPE SEPARATION
DEPOSITION
Plasma-activated ion-beam reactive sputtering of NbN thin films, 15:2898 (R;US)
DEPTH
Noncontacting laser ultrasonic generation and detection at the surface of molten metal, 15:2834 (R;US)
DESALINATION
Final report on the investigation of water purification and waste concentration by the Vacuum Freezing Multiple Phase Transformation Process and its eutectic extension, September 1986-September 1987, 15:3572 (R;US)
DESERTRON
See SUPERCONDUCTING SUPER COLLIDER
DESICCANTS
Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems, 15:2340 (BA;US)
Measurement uncertainty of adsorption testing of desiccant materials, 15:2341 (BA;US)
DESIGN
Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)
DESOXYRIBONUCLEIC ACID
See DNA
DETECTORS (RADIATION)
See RADIATION DETECTORS
DEUTERIUM
A finite temperature theory of rotationally inelastic diffraction: H_2, HD, and D_2 on Cu(100), 15:4243 (J;US)
Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)
Horizontal cold source friction losses of D_2 model with coaxial tubes comparison of calculated values with experimental results in D_2, 15:2259 (TG;US)
In-situ ion beam measurements of deuterium loading in thin foil electrochemical cells, 15:2853 (R;US)

Quantum mechanical reactive scattering theory for simple chemical reactions: Recent developments in methodology and applications, 15:3077 (R;US)
Quantum state-resolved study of pure rotational excitation of CO_2 by hot atoms, 15:3933 (J;US)
The reactions of iron clusters with water, 15:3091 (J;US)

DEUTERIUM COMPOUNDS
Cluster-impact fusion, 15:4240 (J;US)

DEUTERIUM HYDRIDE
See HYDROGEN DEUTERIDE

DEUTERIUM OXIDES
See HEAVY WATER

DEUTERIUM TARGET
Cold nuclear fusion in metallic hydrogen and normal metals, 15:4169 (J;US)
Fusion rates for hydrogen isotopic molecules of relevance for "cold fusion", 15:4175 (J;US)

DEUTERON REACTIONS
Cold nuclear fusion in metallic hydrogen and normal metals, 15:4169 (J;US)
Fusion rates for hydrogen isotopic molecules of relevance for "cold fusion", 15:4175 (J;US)
Muon spectrum and convoy effects after muon-catalyzed fusion, 15:4177 (J;US)

DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
DEUTERON REACTIONS

DEUTERONS
The b_1 structure function and nuclear pions, 15:4126 (R;US)

DEVELOPING COUNTRIES
See also INDIA
REPUBLIC OF KOREA
SOMALIA
TURKEY
Festive colloquium to celebrate the 70th anniversary of Prof. em. o. Dr.-Ing. Friedrich Adler. Berlin, October 17, 1986, 15:2085 (R;DE;In German)
Safe disposal of hazardous wastes: The special needs and problems of developing countries. Volume 1-Volume 3. World Bank technical paper, 15:2750 (R;US)
Special problems in the exploration and operation of loose-rock open-pit mines in developing and threshold countries, 15:2082 (RA;DE;In German)
Technical and economic factors influencing the exploration of black-coal deposits in developing countries, 15:2081 (RA;DE;In German)

DEVICES
See EQUIPMENT

DIAGNOSTIC TECHNIQUES
See also BIOMEDICAL RADIOGRAPHY
NMR IMAGING
SBS [stimulated Brillouin scattering] pulse distortion in multimode optical fibers: Preliminary results, 15:4451 (R;US)

DIAGRAMS
PLOTnFIT: A BASIC program for data plotting and curve fitting, 15:4522 (R;US)

DIAMOND COUNTERS
See CRYSTAL COUNTERS

DIAMONDS
Adsorption of NO on diamond C(111)-(2×1) by band-gap excitation, 15:3003 (J;US)

DIATOMS
Transport and transfer rates in the waters of the continental shelf and slope: SEEP: Triennial report, 1 May 1987–30 April 1990, 15:3817 (R;US)

DIBORANE
See BORANES

DICHLORODIETHYLAMINE
See NITROGEN MUSTARD

DICHLOROMETHANE
See METHYLENE CHLORIDE

DIENES
See also BUTADIENE
Dissociation of cyclohexene and 1,4-cyclohexadiene in a molecular beam, 15:3098 (J;US)

DIESEL ENGINES
A case study of a no storage wind/diesel system: Block Island, 15:2400 (BA;US)
Coal-fueled diesel systems research: Volume 1, Basic fuel, fuel system, and combustion studies: Final report, 15:2798 (R;US)
Coal-fueled diesel systems research: Volume 2, Engine operation, durability and economic: Final report, 15:2799 (R;US)
Determination of the dependence of engine characteristics on the properties of alternative fuels, 15:2800 (R;DE;In German)
Development of mechanical-pilot injection device for automotive diesel engines, 15:2786 (R;JP)
Development of the University of Massachusetts wind/diesel simulator, 15:2299 (BA;US)
Environmental aspects of coal-fueled diesel engines, 15:2080 (BA;US)
Fuel-injected system for diesel engines with injection pressure control, 15:2787 (R;JP)
Sliding seal materials for low heat rejection engines, 15:2783 (R;US)

DIESEL FUELS
Determination of the dependence of engine characteristics on the properties of alternative fuels, 15:2800 (R;DE;In German)

DIESEL OIL (FRACTION)
See DIESEL FUELS

DIFFERENTIAL EQUATIONS
See also NEUTRON DIFFUSION EQUATION
PARTIAL DIFFERENTIAL EQUATIONS
A comparison result and elliptic equations involving subcritical exponents, 15:4510 (R;US)

DIFFRACTION (X-RAY)
See X-RAY DIFFRACTION

DIFFUSION
See also OSMOSIS
Self similar solutions of the second kind of nonlinear diffusion-type equations, 15:4273 (R;XA)

DIGESTER GAS
See METHANE

DIGESTION
Comparison of digestion procedures used for the determination of boron in biological tissues by ICP-AES [inductively-coupled, plasma-atomic emission spectroscopy], 15:3609 (R;US)

DIMERS
Brownian motion and finite-temperature effects in the discrete nonlinear Schroedinger equation: Analytic results for the nonadiabatic dimer, 15:4246 (J;US)

DIMETHYLBENZENES
See XYLENES

DIODES (SEMICONDUCTOR)
See SEMICONDUCTOR DIODES

DIOXIN
A perspective on human exposure to PCDDs and PCDFs emitted form municipal waste combustors, 15:3758 (R;US)

DIPHENYLPHOSPHINE OXIDE
See ORGANIC PHOSPHORUS COMPOUNDS

DIRAC APPROXIMATION
Dirac-Fock calculations in multi-harmonic-oscillator basis, 15:4507 (R;FR;In French)

DIRAC EQUATION
Bound states of the Dirac equation outside a hard sphere, 15:4290 (J;US)
SU(4) proprerties of the Dirac equation, 15:4032 (R;BR)

DISASTERS
Volunteering for emergency preparedness. Final report, March 1988-March 1989, 15:4550 (R;US)
[Emergency planning for technological and natural hazards]: Foreign trip report, October 1, 1989–October 15, 1989, 15:2594 (R;US)

DISCHARGES (ELECTRIC)
See ELECTRIC DISCHARGES

DISCHARGES (IONIZATION)
See IONIZATION

DISCHARGES (WASTES)
See WASTE DISPOSAL
DISINTEGRATION (FISSION)
See FISSION
DISMANTLING (REACTOR)
See REACTOR DISMANTLING
DISPERSANTS (CHEMICAL)
See SURFACTANTS
DISPLAY DEVICES
Human factors evaluation of electroluminescent display #1, 15:3126 (R;US)
DISPOSAL (WASTES)
See WASTE DISPOSAL
DISSOLVED MATERIALS
See SOLUTES
DISSOLVED OXYGEN
See OXYGEN
DISTRICT HEATING
District heating connections with high consumption, 15:2761 (R;DK;In Danish)
Quality control and requirements for corona heated HDPE casing for district heating pipelines, 15:2779 (R;SE;In Swedish)
DISTRICT OF COLUMBIA
See WASHINGTON DC
DISUSED MINESHAFTS
See ABANDONED SHAFTS
DIVERTORS
See also POLOIDAL FIELD DIVERTORS
Design of DIII-D Advanced Divertor, 15:4410 (R;US)
DNA
See also RECOMBINANT DNA
Biological Radiation Effects
Production of oxidative DNA damage during the metabolic activation of benzo[α]pyrene in human mammary epithelial cells correlates with cell killing, 15:3794 (J;US)
Biological Repair
Enzymatic repair of oxidative DNA damage, 15:3735 (RA;DE)
Damage
Background levels of DNA damage, 15:3724 (RA;DE)
DNA damage in frozen aqueous solution: Sequence dependence and end groups, 15:3711 (RA;DE)
Free radical and radiation-induced DNA damage to oligonucleotides, 15:3721 (RA;DE)
Free-radical- and radiation-induced damage to DNA, 15:3699 (R;DE)
Radical-induced DNA damage and specific implications in evaluating genetic changes, 15:3722 (RA;DE)
Studies of radiation damage using DNA oligomers, 15:3723 (RA;DE)
Electron Spin Resonance
Free radical formation in single crystals of 2-deoxyguanosine 5'-monophosphate, and guanine hydrobromide monohydrate after X-irradiation at 10 and 65 K: An ESR, ENDOR and FSE study, 15:3712 (RA;DE)
Free radicals from solid oriented DNA-fibers: Facts and fancy, 15:3709 (RA;DE)
Free radicals in irradiated oriented DNA fibers: Results from B-form DNA and from deuterated DNA samples, 15:3734 (RA;DE)
Enzymes
Binding of adenosine diphosphoribosyltransferase to the termini and internal regions of linear DNAs (deoxyribonucleic acids), 15:3597 (R;US)
Gamma Radiation
Free radical and radiation-induced DNA damage to oligonucleotides, 15:3721 (RA;DE)
Oxygen enhancement of free radical damage to DNA. A comparison of radiation-induced degradation with copper-catalyzed degradation by H_2O_2, 15:3701 (RA;DE)
The effect of oxygen and thiols on the radiation damage of DNA, 15:3715 (RA;DE)
Local Radiation Effects
Radiation induced clustered damage in DNA, 15:3706 (RA;DE)
Methylation
Effect of gamma radiation on DNA methylation, 15:3690 (R;US)
Oxygen Enhancement Ratio
Oxygen enhancement of free radical damage to DNA. A comparison of radiation-induced degradation with copper-catalyzed degradation by H_2O_2, 15:3701 (RA;DE)
Radiolysis
Free-radical- and radiation-induced damage to DNA, 15:3699 (R;DE)
Pulse radiolysis of DNA - effects of environment, 15:3705 (RA;DE)
Secondary reaction in irradiated nucleotides: Possible significance for chemical 'repair' mechanisms, 15:3725 (RA;DE)
Radiosensitivity
The competition between oxidants (radiosensitizers) and reductants (radioprotectors) in modifying free-radical damage to DNA, 15:3710 (RA;DE)
Response Modifying Factors
The effect of oxygen and thiols on the radiation damage of DNA, 15:3715 (RA;DE)
Strand Breaks
Induction and repair of DNA strand-breaks in Bacteroides fragilis, 15:3598 (R;US)
Thermodynamics
The thermodynamic basis of the genetic code, 15:3731 (RA;DE)
DNA ADDUCTS
Interactions of carcinogens with DNA [deoxyribonucleic acid]: Final progress report, July 1, 1987–July 31, 1989, 15:3760 (R;US)
The impact of energy related pollutants on chromosome structure: Progrss report, May 1, 1987–April 30, 1990, 15:3761 (R;US)
DNA HELICASES
Transcription of oxygen-regulated photosynthetic genes requires DNA gyrase in Rhodobacter capsulatus, 15:3606 (J;US)
DOCUMENT RETRIEVAL
See INFORMATION RETRIEVAL
DOCUMENTATION
Documentation of the first measuring campaign of September 8-12, 1986 within the framework of the research project 'Dispersion of pollutants in complex terrain after short-term emissions', 15:3392 (R;DE;In German)
DOLOMITE
Dating of aragonite and dolomite from Devil's cave - SP, by dosimetric thermoluminescent method (DTL) and ESR, 15:3057 (R;BR;In Portuguese)
DOMESTIC WASTES
See MUNICIPAL WASTES
DOPED MATERIALS
Creep of chromia and yttria-doped chromia, 15:2902 (R;US)
DORMITORIES
See RESIDENTIAL BUILDINGS
DOSE EQUIVALENTS
Hanford environmental dose reconstruction project: Technical approach, 15:3750 (R;US)
Meteorological monitoring for environmental/dose assessment and emergency response modeling: How much is enough?, 15:3488 (R;US)
Population dose commitments due to radioactive releases from nuclear power plant sites in 1986, 15:2539 (R;US)
The Hanford Environmental Dose Reconstruction Project: Overview, 15:3749 (R;US)
DOSE LIMITS
Dose limits, 15:4192 (R;AU)
DOSE RATES
Analysis of fallout prediction codes including the Fallout Assessment system (FAS). Master's thesis, 15:3383 (R;US)
DOSE REDUCTION FACTOR
See EFFICIENCY
RADIOPROTECTIVE SUBSTANCES
DOSE RELATIVE FACTOR
See EFFICIENCY
RADIOPROTECTIVE SUBSTANCES
DOSE-RESPONSE RELATIONSHIPS
Methods of prophylaxis of local radiation injuries based on use of radiobiological models, 15:3660 (RA;SU;In Russian)

Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)

DOUBLE BETA DECAY
Calculation of 2ν double beta decay of ^{76}Ge, ^{82}Se, $^{128,130}Te$, 15:4137 (RA;DE)
Double beta decay matrix elements in the Germanium region, 15:4133 (R;XA)

DOUBLET 3 DEVICES
See DOUBLET REACTORS

DOUBLET REACTORS
Mechanical design of the Inside Launch system for electron cyclotron heating in DIII-D, 15:4407 (R;US)

DOW GASIFICATION PROCESS
Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1987. Report for 1 January-31 December 1987, 15:2039 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual report. Report for 1 April 1988-31 March 1989, 15:2043 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1987. Report for 1 January-31 March 1987, 15:2035 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1986. Report for 1 January-31 March 1986, 15:2031 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1986. Report for 1 October-31 December 1986, 15:2034 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2042 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1987. Report for 1 October-31 December 1987, 15:2038 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1989. Report for 1 April-30 June 1989, 15:2044 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1987. Report for 1 April-30 June 1987, 15:2036 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1988. Report for 1 April-30 June 1988, 15:2040 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1986. Report for 1 April-30 June 1986, 15:2032 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1986. Report for 1 July-30 September 1986, 15:2033 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1988. Report for 1 July-30 September 1988, 15:2041 (R;US)
Environmental Monitoring plan for the Dow Syngas Project. Quarterly report: Third quarter, 1987. Report for 1 July-30 September 1987, 15:2037 (R;US)

DOW PUSHER 700
See POLYAMIDES

DPO
See ORGANIC PHOSPHORUS COMPOUNDS

DRAFT CONTROL SYSTEMS
FGD [flue gas desulfurization] damper guidelines: Volume 1, Fundamentals and survey results: Final report, 15:2070 (R;US)
FGD damper guidelines: Volume 2, Guidelines: Final report, 15:2071 (R;US)

DRAG EFFECT
See ELECTROPHORESIS

DREDGE SPOIL
Current and suspended sediment measurements on the central California continental shelf, 15:3819 (R;US)

DRELL MODEL
Meteorite tracking network, 15:4151 (RA;DE;In German)

DRF
See EFFICIENCY
RADIOPROTECTIVE SUBSTANCES

DRIFT CHAMBERS
Development of a 4π-detector system to be used at the SIS/ESR accelerator of the GSI/Darmstadt, 15:3339 (RA;DE;In German)

DRILL HOLES
See BOREHOLES

DRILL SHIPS
See OFFSHORE PLATFORMS

DRILLING PLATFORMS
See OFFSHORE PLATFORMS

DRINKING WATER
Case-control study of bladder cancer in Massachusetts among populations receiving chlorinated and chloraminated drinking water, 15:3771 (R;US)
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)
Formation and control of non-trihalomethane by-products, 15:3556 (R;US)
Ground water protection efforts in four new england states. Technical report, 15:3588 (R;US)
Heavy metals in drinking water: Standards, sources, and effects. January 1978-September 1989 (Citations from the Life Sciences Collection data base). Report for January 1978-September 1989, 15:3564 (R;US)
Influence of discharge and urbanization on the concentration, speciation, and bioavailability of trace metals in the Raritan River, New Jersey. Final report, 15:3551 (R;US)
Translating research into practice: The drinking-water industry, 15:3578 (R;US)

DROPLETS
Statistical properties and numerical implementation of a model for droplet dispersion in a turbulent gas, 15:3939 (J;US)

DRUGS
See also RADIOPROTECTIVE SUBSTANCES
Analysis by X-ray diffraction of new esquiatosomicides, 15:4222 (R;BR;In Portuguese)

DRY DEPOSITION
See DEPOSITION

DRY-TYPE COOLING TOWERS
See COOLING TOWERS

DTO
See DEUTERIUM COMPOUNDS
HEAVY WATER
TRITIUM COMPOUNDS

DUAL-PURPOSE POWER PLANTS
Measurements of gas concentrations and temperature in a boiler room, 15:2428 (R;DK;In Danish)
The DESONOX flue gas purification process, 15:2427 (R;DE;In German)
Utilization of computerized control for optimization of energy systems, 15:2762 (R;DK;In Danish)

DUCTS
Calculation of turbulence-driven secondary motion in ducts with arbitrary cross section, 15:3206 (R;US)
Thermohydraulic analysis of smooth and finned annular ducts, 15:3189 (R;BR;In Portuguese)

DUSTS
Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)
Investigation of explosion with delayed start ($\geq$ 150 m) and methods of prevention. Final report, 15:2104 (R;DE;In German)
Laboratory charging of dust by electrons and ions, 15:4229 (RA;DE;In German)
Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey, 15:3456 (R;US)

DYE LASERS
300-Watt dye laser for field experimental site, 15:3143 (R;US)

Modulation mixing in a multimode dye laser, 15:3153 (R;US)
Transition from quantum-noise-driven dynamics to deterministic dynamics in a multimode laser, 15:3183 (J;US)

DYMAC SYSTEM
See PLUTONIUM

DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See PLUTONIUM

DYNAMICS
Construction of second constant of motion for two dimensional classical super systems, 15:4263 (R;XA)

DYSPROSIUM
Study for the determination of samarium, europium,terbium, dysprosium and yttrium in gadolinium oxide matrix by means of atomic absorption spectrophotometry using a graphite furnace, 15:3058 (R;BR;In Portuguese)

DYSPROSIUM 152
Measurement of γ angular distributions in ^{152}Dy and ^{152,153}Ho, 15:4104 (RA;DE;In German)
Study of the structure of the transition nuclei ^{152}Dy, ^{154}Dy and ^{156}Er at high angular momentum, 15:4088 (R;FR;In French)

DYSPROSIUM 154
Study of the structure of the transition nuclei ^{152}Dy, ^{154}Dy and ^{156}Er at high angular momentum, 15:4088 (R;FR;In French)

DYSPROSIUM 160 TARGET
Transfer reactions with very heavy ions. Quarterly report 3. quarter 1987, 15:4106 (R;FI)

DYSPROSIUM 162 TARGET
Transfer reactions with very heavy ions. Quarterly report 3. quarter 1987, 15:4106 (R;FI)

DYSPROSIUM COMPOUNDS
Resistivity measurements of superconducting materials. Master's thesis, 15:2932 (R;PK)

E

E4-TRANSITIONS
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

EARLY RADIATION INJURIES
See RADIATION INJURIES

EARTH ATMOSPHERE
See also EARTH MAGNETOSPHERE
IONOSPHERE
STRATOSPHERE
TROPOSPHERE
Concentration profiles from lidar measurements in the presence of multiple scattering: the two-stream approximation, 15:3473 (J;US)
Verification study of a three-dimensional local scale atmospheric model PHYSIC at seacoast region, 15:3479 (R;JP)

EARTH MAGNETOSPHERE
See also MAGNETOTAIL
Space radiation environment at 840 km, 15:3881 (R;US)

EARTH PLANET
See also NORTHERN HEMISPHERE
Rapid inversion of multi-dimensional magnetotelluric data, 15:3805 (R;US)

EARTHQUAKES
Earthquake strong ground motion studies at the Idaho National Engineering Laboratory, 15:3807 (R;US)
Self-similar growth of three-dimensional fault, 15:3810 (R;XA)
Thermal stress and seismogenesis, 15:3809 (R;XA)

EASTON POWER REACTOR
See FITZPATRICK REACTOR

EBR-2 REACTOR
Expert system applications in support of system diagnostics and prognostics at EBR-II, 15:2505 (R;US)
Faster-than-real-time simulation for plant control, 15:2478 (R;US)
LMR design to facilitate control, 15:2500 (R;US)
SASSYS validation with the EBR-II shutdown heat removal tests, 15:2506 (R;US)
Safety aspects of the IFR pyroprocess fuel cycle, 15:2502 (R;US)
Thermal hydraulic analysis of fuel reprocessing Argon Cell accidents in the demonstration integral fast reactor, 15:2459 (R;US)

ECCS
See also CORE FLOODING SYSTEMS
Closeout of IE Bulletin 86-01: Minimum flow logic problems that could disable residual heat removal pumps: Minimum flow logic problems that could disable residual heat removal pumps, 15:2544 (R;US)
Reliability study of low pressure recirculation system of Angra 1, 15:2448 (R;BR;In Portuguese)

ECOLOGICAL COMMUNITIES
See ECOSYSTEMS

ECONOMIZERS
Guidelines for the prevention of economizer inlet header cracking in fossil boilers: Final report, 15:2412 (R;US)

ECOSYSTEMS
See also AQUATIC ECOSYSTEMS
TERRESTRIAL ECOSYSTEMS
Assessment of ecologic risks related to chemical exposure: Methods and strategies used in the United States, 15:3772 (R;US)
ELF (extremely low frequency) communications system ecological monitoring program: Electromagnetic field measurements and engineering support – 1988. Technical report, 1982-1988, 15:3795 (R;US)
[Ecosystem research on Walker Branch watershed]: Foreign trip report, October 22–28, 1989, 15:3499 (R;US)

ECR
See ELECTRON CYCLOTRON-RESONANCE

ECR HEATING
Effect of finite fast electron confinement on ECRH and LH current drive and heating, 15:4324 (RA;JP)

EDUCATION
Computerized Adaptive Testing, 15:4532 (R;US)

EDUCATIONAL FACILITIES
See also SCHOOL BUILDINGS
Waste audit study: Research and educational institutions, 15:2746 (R;US)

EFFICIENCY
See also ENERGY EFFICIENCY
Efficiency measurements of ventilation, 15:2705 (R;FI;In Finnish)

EFFLUENTS (GASEOUS)
See GASEOUS WASTES

EFFLUENTS (LIQUID)
See LIQUID WASTES

EFFLUENTS (RADIOACTIVE)
See RADIOACTIVE EFFLUENTS

EFFUSION
See DIFFUSION

EGGS
Strontium-90 in Canada goose eggshells: Non-fatal monitoring for contamination in wildlife, 15:3515 (R;US)

EHF RADIATION
See MICROWAVE RADIATION

EIIP
See INDUSTRIAL PARKS

EINSTEIN GRAVITATION THEORY
See GENERAL RELATIVITY THEORY

EINSTEIN-DE SITTER MODEL
See COSMOLOGICAL MODELS

EINSTEINIUM 254
Results from heavy-ion bombardments of ^{254}Es, 15:4122 (R;US)

ELASTIC PROPERTIES
See ELASTICITY

ELASTICITY
Error analysis of some Galerkin - least squares methods for the elasticity equations, 15:3192 (R;BR)

ELASTOMERS
Plastics and elastomers: Radiation crosslinking. April 1986-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for April 1986-September 1989, 15:2981 (R;US)

ELECTRIC BATTERIES
See also LEAD-ACID BATTERIES
METAL-NONMETAL BATTERIES

A cost effective battery bank for I^2t testing and evaluation of electrical switchgear, 15:4432 (R;US)
Assessment of EV batteries and application to R and D planning, 15:2588 (B;US)
Assessment of battery technologies for electric vehicles: Volume 1, 15:2576 (R;US)
Battery technology assessment and R and D plan, 15:2793 (R;US)
Electric vehicle battery R and D in the context of a propulsion system, 15:2584 (B;US)
Evaluation of state-of-charge indicator approaches for EVs, 15:2585 (B;US)
High-power-density prime power systems: A literature search and analysis, 15:2581 (R;US)
Laboratory evaluation of advanced battery technologies for electric vehicle applications, 15:2582 (B;US)
Lithium-polymer-electrolyte battery: Electrochemical behavior of cathode materials. Technical report, July 1988-June 1989, 15:2567 (R;US)
Technology Base Research Project for electrochemical energy storage: Annual report for 1988, 15:2578 (R;US)

ELECTRIC CABLES
Loss-of-coolant accident (LOCA) testing of aged cables for nuclear plant life extension, 15:2476 (R;US)

ELECTRIC CHARGES
See also POINT CHARGE
Bias and oxide thickness dependence of trapped-charge buildup in MOS (metal oxide semiconductors) devices. Technical report, 15:3222 (R;US)

ELECTRIC CONDENSERS
See CAPACITORS

ELECTRIC DISCHARGES
Experimental study of microwave transmission through a decaying plasma. Final report, January 1986-February 1988, 15:3936 (R;US)

ELECTRIC FIELDS
EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 2: Technical reference manual, 15:2425 (R;US)
Stochastic acceleration of relativistic particles, 15:3826 (RA;DE;In German)

ELECTRIC HEXADECAPOLE TRANSITIONS
See E4-TRANSITIONS

ELECTRIC MONOPOLES
See ELECTRIC CHARGES

ELECTRIC MOTORS
Adjustable speed drive study, June 1985–September 1988: Part 2, Appendices, 15:3224 (R;US)
Composite ceramic superconducting wires for electric-motor applications. Annual report No. 1, 30 June 1988-30 June 1989, 15:3117 (R;US)

ELECTRIC POWER
See also HYDROELECTRIC POWER
1989 reliability assessment: The future of bulk electric system reliability in North America, 1989–1998, 15:2639 (R;US)
Danish electricity supply. Statistics 1987., 15:2642 (B;DK;In Danish)
Dynamic cooperative electricity exchange in a power pool. Research report, 15:2640 (R;FI)
Evaluation methods in competitive bidding for electric power: Volume 2, Technical appendix, 15:2635 (R;US)
Industrial load management at Vaargaarda, 15:2641 (R;SE;In Swedish)
Space applications of fusion energy, 15:2493 (J;US)

ELECTRIC POWER INDUSTRY
The electric-utility industry perspective, 15:2627 (RA;US)

ELECTRIC UTILITIES
1988 survey of residential-sector demand-side management programs: Final report, 15:2645 (R;US)
Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988, 15:2418 (R;US)
Crystalline silicon photovoltaic cell technology: Meeting the challenge for utility power, 15:2313 (BA;US)
Danish electricity supply. Statistics 1987., 15:2642 (B;DK;In Danish)
Evaluation of fuel cell technologies for electric utility applications, 15:2758 (R;US)
FGD [flue gas desulfurization] damper guidelines: Volume 1, Fundamentals and survey results: Final report, 15:2070 (R;US)
FGD damper guidelines: Volume 2, Guidelines: Final report, 15:2071 (R;US)
Guidelines for a "good" integrated resource plan, 15:2632 (R;US)
Key issues in developing demand-side bidding programs, 15:2636 (R;US)
Knowledge-based system: Voltage and VAR [volt-ampere-reactive] dispatch: Final report, 15:2411 (R;US)
Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)

ELECTRIC-POWERED VEHICLES
See also HYBRID ELECTRIC-POWERED VEHICLES
A simplified battery discharge profile based upon the federal urban driving schedule, 15:2577 (R;US)
Analysis of life cycle costs for electric vans with advanced battery systems, 15:2583 (B;US)
Assessment of EV batteries and application to R and D planning, 15:2588 (B;US)
Battery technology assessment and R and D plan, 15:2793 (R;US)
Characterization of electric vehicle velocity and power profiles using road test data, 15:2792 (R;US)
Development of advanced battery systems for vehicle applications, 15:2587 (B;US)
Electric and hybrid vehicles: Technical background report for the DOE flexible and alternative fuels study, 15:2791 (R;US)
Electric vehicle battery R and D in the context of a propulsion system, 15:2584 (B;US)
Electromagnetic flywheel energy storage for use in electric powered trucks and vehicles for domestic transport, 15:2561 (R;DK;In Danish)
Evaluation of state-of-charge indicator approaches for EVs, 15:2585 (B;US)
Laboratory evaluation of advanced battery technologies for electric vehicle applications, 15:2582 (B;US)
Li/FeS battery design for an electric van, 15:2586 (B;US)
National program plan for electric vehicle battery research and development: Technical plan, 15:2790 (R;US)

ELECTRICAL ENGINEERING
Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering center programs, January-March 1989, with 1989 CEEE events calendar, 15:3133 (R;US)

ELECTRICAL TRANSIENTS
Lightning, surge, and transient protection. December 1982-September 1989 (Citations from the NTIS data base). Report for December 1982-September 1989, 15:2433 (R;US)

ELECTRICITY
See also THERMOELECTRICITY
Electricity use in the Pacific Northwest: Utility historical sales by sector, 1988 and preceding years, 15:2643 (R;US)
International energy annual, 1988, 15:2630 (R;US)
Potential minimum cost of electricity of superconducting coil tokamak power reactors, 15:4395 (R;US)

ELECTROCHEMICAL CELLS
See also ELECTRIC BATTERIES
FUEL CELLS
Calorimetric measurements on electrochemical cells with Pd-D cathodes, 15:2575 (R;US)

ELECTRODES
See also ANODES
CATHODES
Electrode development in monolithic solid oxide fuel cells, 15:2654 (R;US)

ELECTROLUMINESCENCE
Human factors evaluation of electroluminescent display #1, 15:3126 (R;US)

ELECTROLYTE TILES
See MATRIX MATERIALS

ELECTROLYTES
Use of lithium batteries in biomedical devices. Technical report No. 8, July 1988-June 1989, 15:2569 (R;US)
ELECTROLYTIC CELLS
Cell performance of ultra-thin polymer-cathode system: Theoretical energy and power-density projections. Technical report No. 3, July 1988-June 1989, 15:2568 (R;US)
Use of lithium batteries in biomedical devices. Technical report No. 8, July 1988-June 1989, 15:2569 (R;US)
ELECTROMAGNETIC FIELDS
The influence of oscillating electromagnetic fields on membrane structure and function: Synthetic liposome and natural membrane bilayer systems with direct application to the controlled delivery of chemical agents, 15:3802 (R;US)
Thermodynamic principles of the process of the effect of electromagnetic fields on a polymer melt, 15:3799 (R;US)
ELECTROMAGNETIC INTERACTIONS
See also PHOTON-PHOTON INTERACTIONS
Electroweak interactions with gauged baryon and lepton numbers, 15:4061 (J;US)
ELECTROMAGNETIC PULSES
Detection of a chirping electromagnetic signal, 15:4288 (R;US)
Lightning, surge, and transient protection. December 1982-September 1989 (Citations from the NTIS data base). Report for December 1982-September 1989, 15:2433 (R;US)
ELECTROMIGRATION
See ELECTROPHORESIS
ELECTRON ACCEPTOR
See ELECTRONS
ELECTRON BEAM MACHINING
Electron beam (EB) curing of wood surface finishing - lamination of PVC film on wood substrates. Final report STA scientist exchange program JAERI, Takasaki, Japan (September to November 1988), 15:2256 (R;MY)
ELECTRON BEAMS
Effect of electron prebunching on the radiation growth rate in a collective (Raman) free electron laser amplifier, 15:4366 (BA;US)
Investigation of an electron beam evaporative source: Part 1, Theory; Part 2, Measurements, 15:3898 (R;US)
Linear analysis of a free-electron laser coupled to betatron oscillations, 15:3182 (J;US)
RADLAC-II propagation experiments, 15:3895 (R;US)
Radiation of a finite electron-beam pulse in a free-electron laser amplifier, 15:4456 (BA;US)
Study of a plasma edge cathode scheme for electron beam extraction, 15:4365 (BA;US)
ELECTRON COLLISIONS
See also ELECTRON-ION COLLISIONS
ELECTRON-POSITRON COLLISIONS
PHOTON-ELECTRON COLLISIONS
International bulletin on atomic and molecular data for fusion. No. 39, 15:4317 (R;XA)
ELECTRON CONFIGURATION (ATOMS)
See ELECTRONIC STRUCTURE
ELECTRON COOLING
Ultracold ion beam, 15:3293 (RA;DE;In German)
ELECTRON CYCLOTRON-RESONANCE
Effect of resonant-to-bulk electron momentum transfer on the efficiency of electron-cyclotron current-drive, 15:4327 (RA;JP)
ELECTRON CYCLOTRON-RESONANCE HEATING
See ECR HEATING
ELECTRON DENSITY
Spectral characteristics of arc-heated low density plasma flows (3). Helium plasma, 15:3892 (R;JP;In Japanese)
ELECTRON DONOR
See ELECTRONS
ELECTRON DOSIMETRY
Ionizing radiations dosimetry: new results in the megagray range, 15:4184 (R;FR;In French)
ELECTRON EMISSION
Experimental and theoretical study of two center electron emission in 25-MeV/u Mo^{40+} + He collisions, 15:4071 (R;FR)
ELECTRON GAS
Dynamically compressed metals - theory. Final report, 1 February 1986-30 April 1989, 15:4200 (R;US)
Electron correlations and dielectric screening in a layered electron gas, 15:4219 (R;XA)
ELECTRON MICROSCOPES
Computer control of the tunnel barrier width for the scanning tunneling microscope, 15:3374 (J;US)
ELECTRON NEUTRINOS
Neutrino mass: Recent results, 15:3959 (R;US)
ELECTRON PAIRS
Contribution of two-pion annihilation to dilepton emission from proton-nucleon collisions, 15:4008 (J;US)
Pair production from photon-pulse collisions, 15:4016 (J;US)
ELECTRON REACTIONS
^{4}He(e,e'c) coincidence experiments for investigation of charge symmetry in ^{4}He, 15:4072 (RA;DE;In German)
Direct decay of giant resonances in medium-heavy nuclei, 15:4089 (RA;DE;In German)
Emission of fast protons in (e,e'p) coincidence experiments, 15:4085 (RA;DE;In German)
The interference term between nuclear charge and nuclear current matrix elements of the E1 giant resonance in ^{12}C and ^{58}Ni, 15:4075 (RA;DE;In German)
ELECTRON SPECTROMETERS
Development of an electron spectrometer for the HELIOS heavy ion experiment at CERN, 15:3346 (RA;DE;In German)
Energy calibration and quantitative analysis with ESCA, 15:3351 (RA;DE;In German)
ELECTRON-ELECTRON COUPLING
Strongly correlated quasi-one-dimensional bands: Ground states, optical absorption, and phonons, 15:4231 (R;US)
ELECTRON-ION COLLISIONS
Collision-radiation recombination, 15:3345 (RA;DE;In German)
Dielectronic recombination, 15:3890 (RA;DE;In German)
Laser-induced electron-ion interaction, 15:3889 (RA;DE;In German)
ELECTRON-NUCLEON INTERACTIONS
Chiral symmetry restoration and quasi-elastic electron-nucleus scattering, 15:4019 (R;US)
ELECTRON-POSITRON COLLISIONS
Electron-positron momentum distribution measurements of high-T superconductors and related systems, 15:4258 (R;US)
ELECTRON-POSITRON INTERACTIONS
A search for single electron production in electron positron annihilation at E = 29 GeV, 15:3964 (R;US)
Multiplicity distribution of particles from string fragmentation calculated in a statistical model, 15:3994 (RA;DE)
Rapidity distribution and scaling violation in a statistical approach to string fragmentation, 15:3993 (RA;DE)
Search for unstable heavy neutral leptons in e^+e^- annihilations at $\sqrt{s}$ from 50 to 60.8 GeV, 15:3970 (J;US)
Study of four-lepton final states in electron-positron interactions at 29 GeV, 15:3963 (R;US)
ELECTRONIC DATA PROCESSING
See DATA PROCESSING
ELECTRONIC EQUIPMENT
See also AMPLIFIERS
MULTIPLEXERS
OSCILLATORS
POWER SUPPLIES
Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering center programs, January-March 1989, with 1989 CEEE events calendar, 15:3133 (R;US)
Reduction of arsenic wastes in the electronics industry (application to study). Final report, 15:2748 (R;US)
Reduction of solvent wastes in the electronics industry. Waste reduction grant program. Final report, 15:2749 (R;US)
ELECTRONIC STRUCTURE
Variational quantum Monte Carlo calculation of electronic and structural properties of crystals, 15:4235 (R;US)
ELECTRONS
A photon accelerator, 15:3279 (R;US)

A search for single electron production in electron positron annihilation at E = 29 GeV, 15:3964 (R;US)
Electron plasma interactions in crossed fields, 15:4361 (BA;US)
Relativistic dynamics of electrons in intense laser fields, 15:4384 (J;US)

ELECTROPHORESIS
See also TWO-DIMENSIONAL ELECTROPHORESIS
Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:3371 (R;US)

ELECTROPHYSIOLOGY
Electrophysiological systems for neurotoxicity field testing: PEARL II and alternatives, 15:3780 (R;US)

ELECTROSTATIC PRECIPITATORS
Electrostatic precipitation of charged particles from a turbulent flow between coaxial cylinders, 15:3402 (R;US)

ELECTROSTATIC WAVES
See PLASMA WAVES

ELEMENTARY PARTICLES
See also BEAUTY PARTICLES
CHARM PARTICLES
HADRONS
Particle physics experiments 1988, 15:3961 (R;GB)

EMERGENCIES
See ACCIDENTS

EMERGENCY CORE COOLING SYSTEM
See ECCS

EMERGENCY PLANS
Final Environmental Statement related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446): Supplement, 15:3594 (R;US)
Volunteering for emergency preparedness. Final report, March 1988-March 1989, 15:4550 (R;US)

EMERGENCY PROVISIONS
See EMERGENCY PLANS

EMISSION
See also ELECTRON EMISSION
STIMULATED EMISSION
National report for the Netherlands. The IEA energy technology systems analysis project (ETSAP)/Annex 3, 15:3470 (B;NL)

EMISSION (ELECTRON)
See ELECTRON EMISSION

EMP
See ELECTROMAGNETIC PULSES

EMPLOYEES
See PERSONNEL

EMULSIONS
Crude oil emulsions. Abstracts, 15:2108 (R;DE;In German)

ENDANGERED SPECIES
Convention on international trade in endangered species of wild fauna and flora. 1987 annual report. Final report, 15:3613 (R;US)
Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook, 15:2601 (R;US)
Migration of radio-marked whooping cranes from the Aransas-wood buffalo population: Patterns of habitat use, behavior, and survival. Technical report, 15:2602 (R;US)

ENERGETIC SOLAR PARTICLES
See SOLAR PARTICLES

ENERGY
See also GEOTHERMAL ENERGY
NUCLEAR ENERGY
Evaluation of the contributions made by STU (National Swedish Board for Technical Development) to the sphere of energy. Summary and conclusions, 15:2613 (R;SE;In Swedish)

ENERGY ANALYSIS
Energy report 1987/88, 15:2590 (R;DE;In German)

ENERGY CONSERVATION
ACEEE 1988 summer study on energy efficiency in buildings: Proceedings: Volume 7, Community and local government conservation programs, 15:2620 (R;US)
Energy conservation trends understanding the factors that affect conservation gains in the US economy, 15:2644 (R;US)
Three-dimensional modeling of heat transfer from slab floors. Final report, 15:2661 (R;US)

ENERGY CONSUMPTION
A simplified battery discharge profile based upon the federal urban driving schedule, 15:2577 (R;US)
Electric power monthly, August 1989, 15:2634 (R;US)
Electricity use in the Pacific Northwest: Utility historical sales by sector, 1988 and preceding years, 15:2643 (R;US)
Energy report 1987/88, 15:2590 (R;DE;In German)
HERMES-model for Denmark, 15:4525 (R;DK)
Industrial load management at Vaargaarda, 15:2641 (R;SE;In Swedish)
Measuring heat flows in collective heating systems. Illusion or reality, 15:2702 (R;NL;In (In Dutch))
Simulation of the Italian energy system with the DESS-model, 15:2626 (R;DK)

ENERGY DEMAND
HERMES-model for Denmark, 15:4525 (R;DK)
Simulation of the Italian energy system with the DESS-model, 15:2626 (R;DK)

ENERGY EFFICIENCY
Process integration initiative. A review of the process integration activities funded under the Energy Efficiency R and D programme, 15:2732 (R;GB)

ENERGY INTEGRATED INDUSTRIAL PARKS
See INDUSTRIAL PARKS

ENERGY MANAGEMENT
Heating energy flexibility of dwellings, 15:2706 (R;FI;In Finnish)
Review of facility-technology options and their development status. Final report, 15:2604 (R;US)

ENERGY MANAGEMENT SYSTEMS
Building management systems: user experiences, 15:2662 (R;GB)
Energy management, 15:2754 (R;SE;In Swedish)

ENERGY POLICY
Report on the Ministry of Energy's statement regarding subsection 2 of section 12 of act number 293 of 10th June 1981, on the utilization of Denmark's subterranean committee on 26th October 1988, 15:2139 (R;DK;In Danish)

ENERGY SECURITY ACT
Cool Water Coal Gasification Program: Environmental Monitoring Plan. Volume 1-5, Section 1-12, Appendices A-F. Report for 1984-89, 15:2045 (R;US)
Cool Water Coal Gasification Program: Environmental monitoring plan. Final Report, non-proprietary. Executive summary. Report for 1984-1989, 15:2046 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1987. Report for 1 January-31 December 1987, 15:2039 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual report. Report for 1 April 1988-31 March 1989, 15:2043 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1986. Report for 1 January-31 March 1986, 15:2031 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1987. Report for 1 January-31 March 1987, 15:2035 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2042 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1986. Report for 1 October-31 December 1986, 15:2034 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1987. Report for 1 October-31 December 1987, 15:2038 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1986. Report for 1 April-30 June 1986, 15:2032 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1988. Report for 1 April-30 June 1988, 15:2040 (R;US)

Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1989. Report for 1 April-30 June 1989, 15:2044 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1987. Report for 1 April-30 June 1987, 15:2036 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1986. Report for 1 July-30 September 1986, 15:2033 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1988. Report for 1 July-30 September 1988, 15:2041 (R;US)
Environmental Monitoring plan for the Dow Syngas Project. Quarterly report: Third quarter, 1987. Report for 1 July-30 September 1987, 15:2037 (R;US)
Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan quarterly report, first quarter, 1989. Report for 1 January 1989-31 March 1989, 15:2158 (R;US)
Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan supplemental environmental data report. Volume 1. Trial trip sampling results. Report for 1 January 1988-31 March 1989, 15:2159 (R;US)
Unocal Parachute Creek shale-oil Program. Environmental Monitoring Plan quarterly report, fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2157 (R;US)

ENERGY SOURCES
See also FOSSIL FUELS
NUCLEAR FUELS
RENEWABLE ENERGY SOURCES
WOOD FUELS
Disasters and market response: An economists perspective on the management of urban emergencies, 15:2593 (R;US)
Short-term energy outlook: Quarterly projections, 15:2623 (R;US)

ENERGY SUPPLIES
Energy report 1987/88, 15:2590 (R;DE;In German)
Residential cogeneration system development. Annual interim report, February 1988-January 1989, 15:2777 (R;US)

ENERGY SYSTEMS
See also COOLING SYSTEMS
ENERGY MANAGEMENT SYSTEMS
HEATING SYSTEMS
HOT-DRY-ROCK SYSTEMS
NATURAL GAS DISTRIBUTION SYSTEMS
SPACE HVAC SYSTEMS
TOTAL ENERGY SYSTEMS
National report for the Netherlands. The IEA energy technology systems analysis project (ETSAP)/Annex 3, 15:3470 (B;NL)

ENGINEERING
See also ELECTRICAL ENGINEERING
HUMAN FACTORS ENGINEERING
Research and technology plans for FY 1989 and accomplishments for FY 1988, 15:2977 (R;US)

ENGINEERING TEST REACTOR
See ETR REACTOR

ENGLAND
See UNITED KINGDOM

ENRICHMENT (ISOTOPIC)
See ISOTOPE SEPARATION

ENVIRONMENT
Environmental impacts: Computer analysis. January 1970-September 1988 (Citations from the NTIS data base). Report for January 1970-September 1988, 15:2596 (R;US)
Environmental impacts: Computer analysis. October 1988-September 1989 (Citations from the NTIS data base). Report for October 1988-September 1989, 15:2597 (R;US)

ENVIRONMENTAL EFFECTS
Beryllium dispersion near explosive firing tables: A comparison of computed and observed results, 15:3468 (R;US)

ENVIRONMENTAL EXPOSURE
Detection of genetic hazards from environmental chemicals with plant test systems, 15:3776 (R;US)
Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)

ENVIRONMENTAL EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS

ENVIRONMENTAL EXPOSURE PATHWAY
Population dose commitments due to radioactive releases from nuclear power plant sites in 1986, 15:2539 (R;US)

ENVIRONMENTAL IMPACTS
Assessment of smolt condition for travel time analysis: Annual report 1988, 15:2279 (R;US)
Environmental impacts: Computer analysis. January 1970-September 1988 (Citations from the NTIS data base). Report for January 1970-September 1988, 15:2596 (R;US)
Environmental impacts: Computer analysis. October 1988-September 1989 (Citations from the NTIS data base). Report for October 1988-September 1989, 15:2597 (R;US)
Integrated computer-based tools to facilitate environmental monitoring, assessment, and restoration, 15:2598 (R;US)
Use of the Multimedia Environmental Pollutant Assessment System (MEPAS) for large- and small-scale applications, 15:2229 (R;US)

ENVIRONMENTAL MATERIALS
Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)

ENVIRONMENTAL POLICY
Summary of commercial conservation programs environmental issues and program consistency, 15:3517 (R;US)
Summary of residential environmental issues and program consistency, 15:2698 (R;US)
US Energy use: New technologies and policies in response to global warming, 15:3408 (R;US)

ENVIRONMENTAL PROTECTION AGENCY
See US EPA

ENVIRONMENTAL QUALITY
See also AIR QUALITY
WATER QUALITY
Environmental data qualification system, 15:4540 (R;US)

ENZYME INHIBITORS
Transcription of oxygen-regulated photosynthetic genes requires DNA gyrase in Rhodobacter capsulatus, 15:3606 (J;US)

ENZYMES
See also DNA HELICASES
OXIDOREDUCTASES
Gene-enzyme relationships in somatic cells and their organismal derivatives in higher plants: Progress report, August 1, 1988–July 31, 1989, 15:3602 (R;US)

EPA
See US EPA

EPOXIDES
Synthesis of epoxidised soya bean oil acrylate, 15:2984 (R;MY)

EPOXY COMPOUNDS
See EPOXIDES

EQUATIONS (DIFFERENTIAL)
See DIFFERENTIAL EQUATIONS

EQUATIONS OF MOTION
Introduction to bifurcation theory, 15:4310 (R;US)

EQUILIBRIUM PLASMA
Free-energy expressions for Vlasov equilibria, 15:4385 (J;US)
Production of high poloidal tokamak equilibria in Versator II by means of RF current drive, 15:4323 (RA;JP)

EQUIPMENT
See also CAPACITIVE ENERGY STORAGE EQUIPMENT
ELECTRONIC EQUIPMENT
LABORATORY EQUIPMENT
MILITARY EQUIPMENT
OPTICAL EQUIPMENT
POLLUTION CONTROL EQUIPMENT
THERMAL ENERGY STORAGE EQUIPMENT
X-RAY EQUIPMENT
How would you know an intelligent system if you saw one?, 15:4511 (R;US)
Uranium enrichment export control guide: Gaseous diffusion, 15:2249 (R;US)

EQUIPMENT PROTECTION DEVICES
See also CIRCUIT BREAKERS
Lightning, surge, and transient protection. December 1982-September 1989 (Citations from the NTIS data base). Report for December 1982-September 1989, 15:2433 (R;US)

ERBIUM 156
Study of the structure of the transition nuclei ^{152}Dy, ^{154}Dy and ^{156}Er at high angular momentum, 15:4088 (R;FR;In French)

ERBIUM 164
Angular momentum dependence of the dipole giant resonance in hot nuclei, 15:4102 (RA;DE;In German)

ERBIUM BORIDES
Superconducting properties of a single-crystal sphere of $ErRh_4B_4$, 15:2954 (J;US)

ERGONOMICS
See HUMAN FACTORS ENGINEERING

ESTUARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS

ETA MESONS
Role of mesonic resonances in antiproton annihilation on nuclei, 15:4173 (J;US)

ETA-549
See ETA MESONS

ETHINE
See ACETYLENE

ETHOCEL
See CELLULOSE

ETHYLENE
Continuous high-temperature lubrication of ceramics by carbon generated catalytically, 15:2900 (R;US)
Laser photoelectron spectroscopy of ions: Progress report, 1988–1989, 15:3095 (R;US)
Supercritical fluid thermodynamics for coal processing: Quarterly progress report, July 1, 1989–September 30, 1989, 15:2055 (R;US)

ETHYLENE POLYMERS
See POLYETHYLENES

ETHYNE
See ACETYLENE

ETR REACTOR
Architecture of the ETR systems code, 15:4459 (BA;US)

EUROPIUM
High energy ion beam annealing in implanted CdTe, 15:2994 (BA;US)
Spectrophotometric investigation of addition compounds between neodymium (III) and europium (III) perchorates and hexafluorophosphate and cyclic ligants with two oxygen in opposite position, 15:3055 (R;BR;In Portuguese)
Study for the determination of samarium, europium,terbium, dysprosium and yttrium in gadolinium oxide matrix by means of atomic absorption spectrophotometry using a graphite furnace, 15:3058 (R;BR;In Portuguese)

EXCAVATION
Application of the results of excavation response experiments at climax and the Colorado School of Mines to the development of an experiment for the underground research laboratory, 15:2237 (R;US)

EXCHANGE (HEAT)
See HEAT TRANSFER

EXCIMER LASERS
See also KRYPTON FLUORIDE LASERS
Dissociation and vibrational relaxation of XeF by various collision partners, 15:3146 (R;US)
Excimer lasers: Applied research and commercial development. January 1980-September 1989 (Citations from the Searchable Physics Information Notices data base). Report for January 1980-September 1989, 15:3165 (R;US)
Liquid excimers: lasing Xe_2 and Kr_2 in liquid argon, 15:3179 (J;US)
Ultrahigh brightness XeCl laser system, 15:3170 (BA;US)

EXCITATION
Effect of electron-excitation on radiation damage in ion-irradiated FCC metals, 15:4230 (R;JP;In Japanese)

EXHAUST GASES
Caterpillar 3406 spark-ignited natural-gas-engine emissions on EPA (Environmental Protection Agency) heavy-duty transient test cycle. Topical report, March-December 1988, 15:2801 (R;US)
Measurement of on-road vehicle emission factors in the California South Coast Air Basin. Volume 1. Regulated emissions. Final report, 15:2796 (R;US)
Programmer's guide to MOBILE4 (mobile source emission factor model). Technical report, 15:2797 (R;US)
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)
Use of bioassay methods to evaluate incinerator emissions, 15:3440 (R;US)

EXHAUST SYSTEMS
Development of thermal-resistant catalysts, 15:2795 (R;JP)

EXOTIC ATOMS
See HADRONIC ATOMS

EXPERIMENTAL BREEDER REACTOR-2
See EBR-2 REACTOR

EXPERIMENTAL DATA
Quantification of Hungry Horse Reservoir water level needed to maintain or enhance reservoir fisheries: Methods and data summary, 1983–1987, 15:2278 (R;US)

EXPERIMENTAL FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES

EXPERT SYSTEMS
Hybrid knowledge-based/algorithmic approach to the design of waste-treatment systems, 15:3234 (R;US)
ISIS: An Interactive System for Instruction and Sampling, 15:3483 (R;US)
Incorporating fuzzy data and logical relations in the design of expert systems for nuclear reactors, 15:2483 (BA;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 7. Part A. Time oriented problem solving. Interim report, December 1986-December 1987, 15:4499 (R;US)

EXPLOSIONS
See also CHEMICAL EXPLOSIONS
NUCLEAR EXPLOSIONS
UNDERGROUND EXPLOSIONS
Evolution of reaction center in an explosive material, 15:3106 (R;US)
Investigation of explosion with delayed start ($\geq$ 150 m) and methods of prevention. Final report, 15:2104 (R;DE;In German)

EXPLOSIVES
See also CHEMICAL EXPLOSIVES
Evolution of reaction center in an explosive material, 15:3106 (R;US)

EXPORTS
Uranium enrichment export control guide: Gaseous diffusion, 15:2249 (R;US)

EXPOSURE (RADIATION DOSES)
See RADIATION DOSES

EXPOSURE CHAMBERS
Maintain and operate California Air Resources Board field fumigation facility for experimental use. Final report, 17 December 1987-30 June 1989, 15:3435 (R;US)

EXTREMELY HIGH FREQUENCY RADIATION
See MICROWAVE RADIATION

EYES
See also RETINA
Eye/sensor protection against laser irradiation: Organic nonlinear optical materials. Final report, April-December 1988, 15:3798 (R;US)

F

F CODES
A comparison of results from dynamic-response field tests, 15:2404 (BA;US)
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Verification, example and benchmark problems: Volume 3, 15:2217 (R;US)
Prediction of stochastic blade responses using a filtered noise turbulence model in the FLAP code, 15:2393 (BA;US)
Prediction of stochastic blade responses using measured wind speed data as input to the FLAP code, 15:2392 (BA;US)
Understanding the effect of natural fractures on the hydrofracture stimulation of gas reservoirs, 15:2148 (BA;US)

F0-975 MESONS
Composite scalar mesons in QCD, 15:3988 (R;XA)

FACE CENTERED CUBIC
See FCC LATTICES

FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES

FACILITIES (EDUCATIONAL)
See EDUCATIONAL FACILITIES

FACILITIES (MAINTENANCE)
See MAINTENANCE FACILITIES

FACILITIES (MILITARY)
See MILITARY FACILITIES

FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES

FACILITIES (STORAGE)
See STORAGE FACILITIES

FACILITIES (TERMINAL)
See TERMINAL FACILITIES

FACILITIES (TEST)
See TEST FACILITIES

FALLOUT
Analysis of fallout prediction codes including the Fallout Assessment system (FAS). Master's thesis, 15:3383 (R;US)
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)
Nuclear reactor accidents: Chernobyl, TMI (Three Mile Island), and Windscale. January 1974-September 1989 (Citations from Pollution Abstracts). Report for January 1974-September 1989, 15:2554 (R;US)
Radionuclide deposition and exposure in the Federal Republic of Germany after the Chernobyl accident, 15:3746 (R;US)

FALLOUT PARTICULATES
See FALLOUT
PARTICLES

FANS
See BLOWERS

FAR INFRARED RADIATION
Studies of polymer foam morphology with FIR [far-infrared radiation] laser scattering, 15:2987 (R;US)

FAST BREEDER TYPE REACTORS
See FBR TYPE REACTORS

FAST FISSION
Data for decay Heat Predictions Proceedings of a specialists' meeting, 15:4121 (R;FR)

FAST FLUX TEST FACILITY REACTOR
See FFTF REACTOR

FAST NEUTRONS
High-efficiency fast-neutron detector. Memorandum report, 15:3329 (R;US)

FAST-MIXED SPECTRUM REACTOR
See FBR TYPE REACTORS

FAULT TREE ANALYSIS
Algorithms and programs for evaluating fault trees with multistate components, 15:4519 (R;DE;In German)
Computer-aided event tree analysis by the impact vector method, 15:2475 (R;BR;In Portuguese)

FAULT TREE SYSTEMS
See FAULT TREE ANALYSIS

FBR TYPE REACTORS
See also LMFBR TYPE REACTORS
Design study of high breeding fast reactor. FP gas purge/tube-in-shell metallic fuel fast reactor, 15:2462 (R;JP;In Japanese)

FCC LATTICES
Effect of electron-excitation on radiation damage in ion-irradiated FCC metals, 15:4230 (R;JP;In Japanese)

FEDERAL REGION I
See also MASSACHUSETTS
Ground water protection efforts in four new england states. Technical report, 15:3588 (R;US)

FEDERAL REGION X
See also ALASKA
WASHINGTON
Water pollution: More EPA action needed to improve the quality of heavily polluted waters, 15:3547 (R;US)

FEDERAL WATER POLLUTION CONTROL ACT
See CLEAN WATER ACT

FERMI STATISTICS
Degenerate fermion and Wilson loop in 1+1 dimensions, 15:4021 (R;JP)

FERMI-DIRAC STATISTICS
See FERMI STATISTICS

FERMILAB TEVATRON
Fermilab fixed-target program, 15:3968 (BA;US)
Hadron collider physics at Fermilab, 15:3260 (R;US)
Operational experience with Tevatron I antiproton source, 15:3268 (BA;US)

FERMIONS
See also BARYONS
QUARKS
Z-boson bremsstrahlung in heavy-quark decay, 15:4014 (J;US)

FERTILIZERS
Water hyacinth horticulture management of manure, 15:2735 (R;DK;In Danish)

FESHBACH-PORTER-WEISSKOPF MODEL
See OPTICAL MODELS

FFTF REACTOR
Technical Safety Appraisal of the Fast Flux Test Facility, Westinghouse Hanford Company, 15:2514 (R;US)

FIBER OPTICS
Beam propagation, 15:3992 (R;SE)
Fiber-optic wavelength-division multiplexing and demultiplexing using volume holographic gratings, 15:3373 (J;US)

FIBERS
Asbestos-fiber reentrainment during vacuuming and wet cleaning of carpet at a captive research site, 15:3437 (R;US)
Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados, 15:3459 (R;US)
Statistical evaluation of airborne asbestos measured before, during, and after abatement, 15:3438 (R;US)
Y-Si-Al-O-N glass fibers. Final report, 15:2967 (R;US)

FIELD EFFECT TRANSISTORS
Broadband cryogenic preamplifiers incorporating GaAs MESFETs for use with low-temperature particle detectors, 15:3232 (J;US)
Effects of normal annealing cycles during IGFET fabrication on initial and radiation-induced gate-insulator defects. Annual progress report, 1 December 1988-7 July 1989, 15:3328 (R;US)
High-energy-neutron irradiation effects in GaAs modulation-doped field effect transistors (MODFETs): Threshold voltage. Technical report, 15:3360 (R;US)

FIELD OPERATORS
ISIS: An Interactive System for Instruction and Sampling, 15:3483 (R;US)

FIELD TESTS
Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 15:2233 (R;US)

FIELD THEORIES
See also GENERAL RELATIVITY THEORY
QUANTUM FIELD THEORY
Momentum-space representation in curved space, 15:4056 (J;US)
Zamolodchikov's *c*-theorem reexamined, 15:4057 (J;US)

FIELDS (ELECTRIC)
See ELECTRIC FIELDS
FIELDS (ELECTROMAGNETIC)
See ELECTROMAGNETIC FIELDS
FIELDS (GRAVITATIONAL)
See GRAVITATIONAL FIELDS
FIELDS (MAGNETIC)
See MAGNETIC FIELDS
FINANCIAL MANAGMENT
See PROGRAM MANAGEMENT
FINGERPRINTING (OIL SPILLS)
See OIL SPILLS
FINLAND
Peat - Environment - Society. Part 2: Emissions from combustion of peat, 15:2073 (R;FI;In Finnish)
FIRE EXTINGUISHERS
Fire-extinguishing agents. January 1970-September 1989 (Citations from the COMPENDEX data base). Report for January 1970-September 1989, 15:2982 (R;US)
FIRE FIGHTING
Fire-extinguishing agents. January 1970-September 1989 (Citations from the COMPENDEX data base). Report for January 1970-September 1989, 15:2982 (R;US)
Health-hazard evaluation report HETA 87-109-1950, North Riverside Fire Department, North Riverside, Illinois, 15:3458 (R;US)
Use of foaming mud cement to terminate underground coal fires and to control subsidence of burn cavities. Final report, 15:2091 (R;US)
FIRE STATIONS
See PUBLIC BUILDINGS
FIREDAMP
See METHANE
FIRES
Analysis of forest-fire smoke using satellite imagery. Master's thesis, 15:3384 (R;US)
FIREWOOD
See WOOD FUELS
FIRS
Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)
FIRST WALL
Calculation of the production cross sections of high-spin isomeric states in hafnium, 15:4429 (R;US)
Neutronics issues for starlight: An inertial confinement fusion reactor concept, 15:4447 (R;US)
Quick installation/removal technology for first wall, 15:4424 (R;JP;In Japanese)
FISCHER-TROPSCH SYNTHESIS
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 4, 15:2263 (R;US)
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 2, 15:2262 (R;US)
Slurry reactor hydrodynamics studies: Final report, 15:2261 (R;US)
Upgrading of light Fischer-Tropsch products: Quarterly report No. 6, January 1, 1988–March 31, 1988, 15:2264 (R;US)
Upgrading of light Fischer-Tropsch products: Quarterly report No. 7, April 1, 1988–June 30, 1988, 15:2265 (R;US)
FISHES
See also ANADROMOUS FISHES
Accumulation of radionuclides in fish during specified normal operation of nuclear installations and after incidents. Annual report 1987, 15:3567 (R;DE;In German)
Hanford environmental dose reconstruction project: Technical approach, 15:3750 (R;US)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Brown rockfish, copper rockfish, and black rockfish, 15:3537 (R;US)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Alewife and blueback herring, 15:3536 (R;US)
FISSILE MATERIALS
Improved neutron monitor systems for Savannah River Site separations facilities, 15:2165 (R;US)
FISSION
See also FAST FISSION
PHOTOFISSION
SPONTANEOUS FISSION
THERMAL FISSION
Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988, 15:4134 (R;XA)
Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1988, 15:4159 (R;JP;In Japanese)
FISSION NEUTRONS
Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988, 15:4134 (R;XA)
FISSION PRODUCT RELEASE
In-core thermal hydraulic and fission product calculations for severe fuel damage analyses, 15:2438 (R;US)
Review on fission product source term from fuel at severe accident conditions, chemical forms and release rates, 15:2534 (R;JP;In Japanese)
Uncertainty analyses for the atmospheric dispersion submodule of UFOMOD with emphasis on parameter correlations, 15:3481 (R;DE)
FISSION PRODUCTS
Data for decay Heat Predictions Proceedings of a specialists' meeting, 15:4121 (R;FR)
More about breathing on the Mesa, 15:3516 (R;US)
FITZPATRICK REACTOR
Development and Testing of a RETRAN/MINET composite code and application to the J.A. Fitzpatrick plant, 15:2496 (R;US)
FIXED BED
See PACKED BED
FLAME PROPAGATION
A tomographic study of premixed turbulent stagnation point flames, 15:3108 (R;US)
FLAMES
Enhanced flame stability and soot radiation using electric fields. Final report, July 1986-January 1989, 15:3114 (R;US)
Optogalvanic spectroscopy in flames, 15:3040 (R;FR;In French)
FLAMMABILITY
Laser probes of natural gas ignition chemistry. Annual report, January-December 1988, 15:2153 (R;US)
FLASKS
See CASKS
FLAWS
See DEFECTS
FLIBE
Translation of reports from the first international conference on neutron physics, Kiev, USSR, 14-18 September 1987, 15:4179 (R;XA)
FLOORS
Three-dimensional modeling of heat transfer from slab floors. Final report, 15:2661 (R;US)
FLOW (FLUID)
See FLUID FLOW
FLOW RATE
Quantification of Hungry Horse Reservoir water level needed to maintain or enhance reservoir fisheries: Methods and data summary, 1983–1987, 15:2278 (R;US)
FLOWMETERS
Wide-range fuel flowmeter. Phase 2. Final report, 4 June 1986-3 February 1988, 15:2121 (R;US)
FLUE GAS
Ammonia addition for NO_x reduction in fluidized bed boilers, 15:2074 (R;SE)
Bench-scale evaluation of calcium sorbents for acid-gas emission control. Report for October 1988-March 1989, 15:3444 (R;US)
Combined NO_x/SO_2 control technology, 15:2421 (R;US)
Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 7, December 1, 1988–February 28, 1989, 15:2422 (R;US)
FGD [flue gas desulfurization] damper guidelines: Volume 1, Fundamentals and survey results: Final report, 15:2070 (R;US)

FGD damper guidelines: Volume 2, Guidelines: Final report, 15:2071 (R;US)
Field testing of a ceramic heat exchanger for heat recovery application, 15:2727 (R;US)
Flue gas condensation in stoking system for wood chips, 15:2272 (R;DK;In Danish)
Flue gas denitrification processes using tissue filters. Final report, 15:2426 (R;DE;In German)
Fluid/particle separation and coal cleaning: Progress, potential advances, and their effects on FGD [flue-gas desulfurization], 15:2420 (R;US)
Hydrogen chloride bonding on dry limestone, 15:3419 (R;DK;In Danish)
Measurement of condensable vapor contribution to PM10 emissions, 15:2696 (R;US)
Removal of acidic gases from incinerator flue gas in a fluidized bed scrubber, 15:2075 (B;US)
The DESONOX flue gas purification process, 15:2427 (R;DE;In German)
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 5, July 1–September 30, 1989, 15:2424 (R;US)
Trial burns: methods perspective, 15:2763 (R;US)

FLUID FLOW
See also COMPRESSIBLE FLOW
GAS FLOW
INCOMPRESSIBLE FLOW
LIQUID FLOW
TURBULENT FLOW
TWO-PHASE FLOW
VORTEX FLOW
Aerothermal modeling program. Phase 2, element A: improved numerical methods for turbulent viscous recirculating flows, 15:3196 (RA;US)
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1, 15:2215 (R;US)
Falling-sphere radioactive viscometry, 15:3190 (R;BR;In Portuguese)

FLUID INJECTION
See also STEAM INJECTION
Jet instabilities in liquid-liquid systems. Application to direct contact heat exchangers, 15:3188 (R;FR;In French)

FLUIDIZED BED
See FLUIDIZED BEDS

FLUIDIZED BED BOILERS
Ammonia addition for NO_x reduction in fluidized bed boilers, 15:2074 (R;SE)
Emission of nitrogen oxide from a circulating fluidized bed boiler - the influence of design parameters, 15:3466 (R;SE)

FLUIDIZED BED REACTORS
Removal of acidic gases from incinerator flue gas in a fluidized bed scrubber, 15:2075 (B;US)
The effect of system parameters on fines generation in limestone/coal char mixtures, 15:2048 (B;US)

FLUIDIZED BEDS
Effect of reductive decomposition of $CaSO_4$ on sulphur capture in fluidised bed boilers, 15:3250 (R;SE)
Is there a strange attractor in a fluidized bed?, 15:2094 (R;US)

FLUIDIZED-BED COMBUSTION
Emission of nitrogen oxide from a circulating fluidized bed boiler - the influence of design parameters, 15:3466 (R;SE)

FLUIDIZED-BED COMBUSTORS
Heat transfer in circulating fluidized bed boilers, 15:2101 (R;SE)
Test plan for valveless ash removal from pressurized fluid bed combustion systems, 15:2095 (R;US)

FLUORESCENCE
Laser probes of natural gas ignition chemistry. Annual report, January-December 1988, 15:2153 (R;US)

FLUORINATED ALIPHATIC HYDROCARBONS
See also FLUOROFORM
METHYL FLUORIDE
Effects of environmental variables on fatigue crack growth rate in steel immersed in seawater, 15:2826 (R;JP)

FLUORINE 18
New techniques for positron emission tomography in the study of human neurological disorders: Progress report, June 15, 1987–November 15, 1989, 15:3616 (R;US)

FLUOROFORM
Supercritical fluid thermodynamics for coal processing: Quarterly progress report, July 1, 1989–September 30, 1989, 15:2055 (R;US)

FLUX (COSMIC RAY)
See COSMIC RAY FLUX

FLY ASH
A process for the preparation of cysteine from cystine, 15:2076 (P;US)
Characterization and modification of particulate properties to enhance filtration performance: Quarterly technical progress report, December 1988–February 1989, 15:2423 (R;US)
Flue gas denitrification processes using tissue filters. Final report, 15:2426 (R;DE;In German)
Mutagenicity of combustion emissions from a biomedical-waste incinerator, 15:3774 (R;US)
Use of ash in highway construction: Delaware demonstration project: Final report, 15:2069 (R;US)

FLYWHEEL ENERGY STORAGE
Flywheel for vehicles, 15:2562 (R;DK;In Danish)

FLYWHEELS
Flywheel for vehicles, 15:2562 (R;DK;In Danish)

FOAMS
Low density microcellular carbon foams and method of preparation, 15:3036 (P;US)
Maximum entropy and equations of state for random cellular structures, 15:2969 (R;US)
Studies of polymer foam morphology with FIR [far-infrared radiation] laser scattering, 15:2987 (R;US)
The influence of texture on steady foam flow in Berea sandstone, 15:2109 (R;US)
The influence of texture on steady foam flow in Berea sandstone, 15:2111 (R;US)

FOG
Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)

FOILS
Airfoil design for horizontal axis wind turbines, 15:2377 (RA;DK)
Design of aerofoils for wind turbine use, 15:2375 (RA;DK)

FOOD
See also ANIMAL FEEDS
MILK
Food and grain preservation through irradiation. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 15:3688 (R;US)
Trends in radionuclide concentrations for wildlife and food products near Hanford for the period 1971 through 1988, 15:2232 (R;US)

FOOD INDUSTRY
Membrane applications in the food industry: Survey and barriers, 15:2728 (R;US)
Toxicity: Polymeric materials in food-contact applications. January 1977-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1977-September 1989, 15:3789 (R;US)

FOODSTUFFS
See FOOD

FORESTS
5th status colloquium of the PEF, March 7-9, 1989 in the Nuclear Research Center in Karlsruhe. Summarizing reviews of the program management, 15:3416 (R;DE;In German)
Physical characteristics of study plots. Across-a-Lake States acidic-deposition gradient. Forest Service resource bulletin, 15:3455 (R;US)

FORMALDEHYDE
Evaluation of the rate constant for the reaction $OH+H_2CO$: Application of modeling and sensitivity analysis techniques for determination of the product branching ratio, 15:3087 (J;US)

Selection of an effective biocide and toxicity evaluation for a specific MEOR [microbial enhanced oil recovery] microbial formulation, 15:2114 (R;US)

FORMALIN
See FORMALDEHYDE

FORMALITH
See FORMALDEHYDE

FORMATION DAMAGE
A correlation for interference testing with wellbore-storage and skin effects, 15:2116 (J;US)

FORMIC ACID
Bimodal kinetic energy release in the unimolecular dissociation of energy-selected formic acid ion, 15:3085 (J;US)

FORMIC ALDEHYDE
See FORMALDEHYDE

FORMOL
See FORMALDEHYDE

FORMYL RADICALS
Bimodal kinetic energy release in the unimolecular dissociation of energy-selected formic acid ion, 15:3085 (J;US)

FOSSIL FUEL RESERVES
See FOSSIL FUELS

FOSSIL FUELS
See also COAL
NATURAL GAS
OIL SANDS
OIL SHALES
PEAT
PETROLEUM
Greenhouse gas emission coefficients from the energy system. Two methods to calculate national CO_2-e issions, 15:2599 (B;NL)
National report for the Netherlands. The IEA energy technology systems analysis project (ETSAP)/Annex 3, 15:3470 (B;NL)
Recent developments of emission control technology in the United States for fossil fuel combustion sources, 15:3249 (R;US)

FOSSIL-FUEL POWER PLANTS
1988 interorganizational workshop on future utility SO_2 emissions, 15:2078 (R;US)
Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988, 15:2418 (R;US)
Development of the advanced utility simulation model. Report for May 1985-September 1988, 15:2430 (R;US)
Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 7, December 1, 1988–February 28, 1989, 15:2422 (R;US)
Environmental issues associated with coal-fired power plants in India, 15:2431 (J;US)
Experiences of DOAS technique for flue gas measurements, 15:3467 (R;SE;In Swedish)
FGD [flue gas desulfurization] damper guidelines: Volume 1, Fundamentals and survey results: Final report, 15:2070 (R;US)
FGD damper guidelines: Volume 2, Guidelines: Final report, 15:2071 (R;US)
Guidelines for the prevention of economizer inlet header cracking in fossil boilers: Final report, 15:2412 (R;US)
Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)
The DESONOX flue gas purification process, 15:2427 (R;DE;In German)
The role of oil in electricity generation in five European countries: Past, present, and potential, 15:2631 (R;US)
[US Agency for International Development–Government of India collaborative coal projects]: Foreign trip report, October 21, 1989–November 2, 1989, 15:2429 (R;US)

FOUNDRIES
MINTOP industrial load management system, 15:2637 (R;SE;In Swedish)

FOWL
Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook, 15:2601 (R;US)
Migration of radio-marked whooping cranes from the Aransas-wood buffalo population: Patterns of habitat use, behavior, and survival. Technical report, 15:2602 (R;US)

FRACTIONATION
Field-flow fractionation in the analysis of energy-related materials: Final report, April 1, 1986–March 31, 1989, 15:3545 (R;US)

FRACTURE MECHANICS
Experience with J testing of 304/308 stainless steel weldment, 15:2833 (R;US)

FRACTURING
Investigation of fracture toughness and fracture mechanisms using acoustic emission measurements: Progress report, 1 March 1989–28 February 1990, 15:2829 (R;US)

FRAGMENTS (FALLOUT)
See FALLOUT

FRAGMENTS (PARTICLES)
See PARTICLES

FRANCO-GERMAN HIGH FLUX REACTOR
See GRENOBLE REACTOR

FREE CONVECTION
See NATURAL CONVECTION

FREE ELECTRON LASERS
1-dimensional single-mode nonlinear FEL amplification code. User's manual, 15:4339 (R;JP;In Japanese)
A study of phase control in the FEL [free electron laser] two-beam accelerator, 15:3272 (R;US)
Applications of RF linacs to free-electron lasers and particle beams, 15:3312 (J;US)
Applications of free-electron laser technology to magnetic fusion, 15:4481 (J;US)
Applications of induction linacs to free-electron lasers and particle beams, 15:3313 (J;US)
Compact rf-linac free-electron lasers, 15:3158 (R;US)
Effect of mode competition on the efficiency of FEL oscillators in the low gain regime, 15:3169 (BA;US)
Electron beam diagnostics study, 15:3363 (R;FR;In French)
Energy conversion efficiency in high current Raman regime free electron laser (FEL), 1. Single mode analysis, 15:4341 (R;JP)
INEX [integrated numerical experiment] simulations of the Los Alamos HIBAF [high-brightness accelerator free-electron laser] free-electron laser MOPA [master oscillator power amplifier] experiment, 15:3298 (R;US)
Lasing on the third harmonic, 15:3156 (R;US)
Linear analysis of a free-electron laser coupled to betatron oscillations, 15:3182 (J;US)
Optical design and performance of an XUV FEL [free-electron laser] oscillator, 15:3159 (R;US)
Radiation of a finite electron-beam pulse in a free-electron laser amplifier, 15:4456 (BA;US)
Theory for high gain, high power free electron lasers: Final report, 15:3166 (R;US)
Theory of harmonic radiation using a single-electron source model, 15:3160 (R;US)
Waveguide mode deformation in free-electron lasers, 15:3181 (J;US)

FREE RADICALS
See RADICALS

FREONS
New chemical alternatives to chlorofluorocarbons and halons. Report for August 1988-February 1989, 15:3436 (R;US)

FRESH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

FRUIT (SEEDS)
See SEEDS

FTR REACTOR (RICHLAND)
See FFTF REACTOR

FUEL CELL POWER PLANTS
Electricity production at fuel cell power plants, 15:3252 (R;FI;In Finnish)

FUEL CELLS
An approach for testing fuel-cell/battery hybrid power sources for bus applications, 15:2658 (R;US)
An assessment and comparison of fuel cells for transportation applications, 15:2794 (R;US)

Effects of coal-derived trace species on the performance of molten carbonate fuel cells: Topical report (Progress report No. 4), 15:2657 (R;US)
Electrode development in monolithic solid oxide fuel cells, 15:2654 (R;US)
Evaluation of fuel cell technologies for electric utility applications, 15:2758 (R;US)
Evaluation of fuel-cell technology for Coast Guard applications. Final report, 15:2653 (R;US)
Interfacial effects in monolithic solid oxide fuel cells, 15:2655 (R;US)
Technology Base Research Project for electrochemical energy storage: Annual report for 1988, 15:2578 (R;US)

FUEL ELEMENT FAILURE
Study on the behavior of PWR remedy fuel under reactivity initiated accident conditions. Effect of pellet shape modification, 15:2533 (R;JP;In Japanese)
Study on the behavior of waterside corroded PWR fuel rods under reactivity initiated accident conditions, 15:2535 (R;JP;In Japanese)

FUEL ELEMENTS
See also FUEL PLATES
FUEL RODS
Advancements in the behavioral modeling of fuel elements and related structures, 15:2504 (R;US)

FUEL FABRICATION PLANTS
Aspects of radiological protection in nuclear installations, 15:4187 (R;BR;In Portuguese)

FUEL GAS
See also HIGH BTU GAS
NATURAL GAS
Use of a charge-coupled device camera for broadband coherent anti-Stokes Raman scattering measurements, 15:3377 (J;US)

FUEL INJECTION SYSTEMS
Development of mechanical-pilot injection device for automotive diesel engines, 15:2786 (R;JP)
Fuel-injected system for diesel engines with injection pressure control, 15:2787 (R;JP)

FUEL PLATES
Status of high-density fuel plates fabrication: Final draft, 15:2164 (R;US)

FUEL REPROCESSING
See REPROCESSING

FUEL REPROCESSING PLANTS
See also SELLAFIELD REPROCESSING PLANT
Applying AI techniques to improve alarm display effectiveness, 15:2247 (BA;US)
Results of the Manipulator Test Test Stand study: Comparison of manipulators and evaluation of equipment items, 15:2170 (R;US)

FUEL ROD CONSOLIDATION
See FUEL RODS

FUEL RODS
Design and operation of gamma scan and fission gas sampling systems for characterization of irradiated commercial nuclear fuel, 15:2440 (R;US)
Review on fission product source term from fuel at severe accident conditions, chemical forms and release rates, 15:2534 (R;JP;In Japanese)

FUEL SLUGS
See FUEL RODS

FUEL SLURRIES
A process for the preparation of cysteine from cystine, 15:2076 (P;US)
Advanced research in instrumentation and control technology, 15:2053 (R;US)
Cavitation-controlled ultrasonic agitator, 15:3366 (R;US)
Coal-fueled diesel systems research: Volume 1, Basic fuel, fuel system, and combustion studies: Final report, 15:2798 (R;US)
Coal-fueled diesel systems research: Volume 2, Engine operation, durability and economic: Final report, 15:2799 (R;US)

FUEL SUBSTITUTION
Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988, 15:2418 (R;US)

FUEL SUSPENSIONS
See FUEL SLURRIES

FUEL SYSTEMS
See also FUEL INJECTION SYSTEMS
Compatibility of fuel-system components with high density fuel. Final report, April 1987-January 1989, 15:2781 (R;US)

FUEL-AIR RATIO
Enhanced flame stability and soot radiation using electric fields. Final report, July 1986-January 1989, 15:3114 (R;US)

FUELS
See also AVIATION FUELS
FOSSIL FUELS
FUEL SLURRIES
GAS FUELS
JET ENGINE FUELS
LIQUID FUELS
NUCLEAR FUELS
SOLID FUELS
SYNTHETIC FUELS
WOOD FUELS
Environmental quality and the shift to alternative fuels: Progress and interim findings of a Department of Energy study of transition in vehicular power systems, 15:3407 (R;US)
Wide-range fuel flowmeter. Phase 2. Final report, 4 June 1986-3 February 1988, 15:2121 (R;US)

FUELS (NUCLEAR)
See NUCLEAR FUELS

FUELWOOD
See WOOD FUELS

FUMES
See AEROSOLS

FUNCTIONS
See also GREEN FUNCTION
PARTITION FUNCTIONS
Weighted fit of parametric functions to distributions: The new interface of HOBOOK with MINUIT, 15:4516 (R;US)

FUNDAMENTAL PARTICLES
See ELEMENTARY PARTICLES

FUNGI
Two-step process for conversion of lignocellulose into methane, 15:2266 (R;DK)

FURANS
A perspective on human exposure to PCDDs and PCDFs emitted form municipal waste combustors, 15:3758 (R;US)

FURNACES
Sonic pyrometry in furnaces. Fundamentals, 15:3253 (R;FI;In Finnish)

FUSED SALTS
See MOLTEN SALTS

FUSES
Inductive store opening switch and tests for energy transfer to a load, 15:3140 (R;US)

FUSION (NUCLEAR)
See THERMONUCLEAR REACTIONS

FUSION ENERGY
See THERMONUCLEAR REACTORS

FUSION REACTORS
See THERMONUCLEAR REACTORS

FUZES
See FUSES

G

GADOLINIUM
Determination of gadolinium in power and pellers of $(U,Gd)O_2$ by ion chromatography without supresion, 15:3050 (R;BR;In Portuguese)

GADOLINIUM SULFIDES
Thermophysical properties of the lanthanide sesquisulfides. I. Schottky functions and magnetic and electronic properties of γ-La_2S_3, γ-Ce_2S_3, γ-Nd_2S_3, and γ-Gd_2S_3, 15:3021 (J;US)

GAGES (STRAIN)
See STRAIN GAGES

GALACTIC EVOLUTION
Origin of the universe from Quantum Chaos: An introduction to current ideas (professor John Dyer Memorial Lecture). Technical report, 15:3820 (R;US)

GALLIUM ARSENIDES
Electroabsorption in single quantum-well GaAs laser structures, 15:3150 (R;US)

Atom Transport
Amorphous phase formation by solid-state reaction between polycrystalline Co thin films and single-crystal GaAs, 15:3014 (J;US)

Carbon Additions
Spatially resolved localized vibrational mode spectroscopy of carbon in liquid encapsulated Czochralski grown gallium arsenide wafers, 15:4233 (R;US)

Electrical Properties
Ultralow recombination velocity at $Ga_{0.5}In_{0.5}P$/GaAs heterointerfaces, 15:3005 (J;US)

Electro-Optical Effects
Electric field response of a semiconductor superlattice optical mirror from electroreflectance spectra, 15:3008 (J;US)

Electronic Structure
Pressure dependence of the *DX* center in $Ga_{1-x}Al_xAs$:Te, 15:3033 (J;US)

Field Effect Transistors
High-energy-neutron irradiation effects in GaAs modulation-doped field effect transistors (MODFETs): Threshold voltage. Technical report, 15:3360 (R;US)

Heterojunctions
Semiconductor quantum-well lasers and related optoelectronic devices on silicon, III-V. Technical report, 15:3145 (R;US)

Industrial Wastes
Reduction of arsenic wastes in the electronics industry (application to study). Final report, 15:2748 (R;US)

Interfaces
Interfacial roughness in InAs/GaAs heterostructures determined by soft x-ray reflectivity, 15:3018 (J;US)

Irradiation
In situ tem observations of heavy ion damage in gallium arsenide, 15:2991 (BA;US)

Photoconductivity
Magnetic studies of persistent photoconductivity in *n*-$Al_xGa_{1-x}As$, 15:3010 (J;US)

Photoemission
Enhanced electron spin polarization in photoemission from thin GaAs, 15:3015 (J;US)

Physical Radiation Effects
Radiation resistance of solar cells for space application, 1. Study on the irradiation procedure of electron beams, 15:2294 (R;JP;In Japanese)

Research Programs
Electronic materials high-T_c superconductivity polymers and composites structural materials surface science and catalysts industry participation: Annual report, 1988, 15:2923 (R;US)

Roughness
Interfacial roughness in InAs/GaAs heterostructures determined by soft x-ray reflectivity, 15:3018 (J;US)

Schottky Barrier Diodes
Niobium and niobium nitride contacts on semiconducting material, 15:3233 (P;US)

Strains
Scaling relations for strained-layer relaxation, 15:3009 (J;US)

Substrates
Ion beam modification of film stress and the effectiveness of thin film encapsulants on GaAs, 15:3001 (BA;US)

Thermionic Emission
Anisotropic thermionic emission of electrons contained in GaAs/AlAs floating gate device structures, 15:3004 (J;US)

GALLIUM COMPOUNDS
See also GALLIUM ARSENIDES
GALLIUM PHOSPHIDES
Amorphous phase formation by solid-state reaction between polycrystalline Co thin films and single-crystal GaAs, 15:3014 (J;US)

GALLIUM PHOSPHIDES
Ultralow recombination velocity at $Ga_{0.5}In_{0.5}P$/GaAs heterointerfaces, 15:3005 (J;US)

GAMMA DOSIMETRY
Ionizing radiations dosimetry: new results in the megagray range, 15:4184 (R;FR;In French)

GAMMA RADIATION
A computer study of source-detector geometries proposed for the induced-emission tomography of transuranic elements, 15:3353 (R;US)
Effects of gamma radiation on Crotalus durissus terrificus venom, 15:3696 (R;BR;In Portuguese)

GAMMA SPECTROMETERS
In situ XRF and gamma ray spectrometer for Mars sample return mission, 15:3355 (RA;US)

GAMMA SPECTROSCOPY
Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole, 15:3390 (R;US)

GAS ANALYSIS
Semiconductor gas sensors. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989, 15:3370 (R;US)

GAS COOLANTS
See GASES

GAS ENGINES
See INTERNAL COMBUSTION ENGINES

GAS FLOW
See also AIR FLOW
Heat and momentum transfer in a gas coolant flow through a circular pipe in a high temperature gas cooled reactor, 15:2453 (R;JP;In Japanese)

GAS FUELS
See also FUEL GAS
Pulsating catalytic combustion of gaseous fuels. Final report, January 1987-September 1988, 15:2152 (R;US)

GAS HYDRATES
Development of a reservoir simulation for thermal recovery of heavy oils/tar sands in the presence of gas hydrates: Final report, 15:2156 (R;US)
Proceedings of the natural gas R&D contractors review meeting, 15:2142 (R;US)

GAS LASERS
See also CARBON DIOXIDE LASERS
EXCIMER LASERS
Binary micro optics: An application to beam steering, 15:3148 (R;US)

GAS TURBINE ENGINES
Aerothermal modeling program. Phase 2, element B: Flow interaction experiment, 15:3197 (RA;US)
Application of advanced diagnostics to airblast injector flows, 15:3198 (RA;US)
Component specific modeling, 15:3241 (RA;US)
Development of a high temperature thin film static strain gage, 15:3367 (RA;US)
Measurement of airfoil heat transfer coefficients on a turbine stage, 15:3199 (RA;US)
Response characteristics of MHOST (MARC Hot-Section Technology) for 3-D inelastic analysis of hot-section components, 15:3239 (RA;US)
Three-dimensional inelastic analysis for hot section components, BEST 3D code, 15:3238 (RA;US)
Two- and three-dimensional turbine blade row flow field simulations, 15:3200 (RA;US)

GAS TURBINE POWER PLANTS
Advanced gas-turbine steam-injection program water treatment for steam-injected gas-turbine systems. Topical report, October 1987-March 1989, 15:2417 (R;US)

GAS TURBINES
Gas turbine blade life assessment and repair guide: Final report, 15:2414 (R;US)
Sialon ceramics. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989, 15:2933 (R;US)

GAS WELLS
See NATURAL GAS WELLS

GASEOUS DIFFUSION PROCESS
Uranium enrichment export control guide: Gaseous diffusion, 15:2249 (R;US)

GASEOUS EFFLUENTS
See GASEOUS WASTES

GASEOUS WASTES
See also EXHAUST GASES
FLUE GAS
Desulfurization of industrial gaseous effluents. Final report, 15:2729 (R;DE;In German)
Investigations on combined deposition of particulate and gaseous pollutants in a packed bed filter at high temperatures, 15:2730 (R;DE;In German)

GASES
See also AIR
ELECTRON GAS
EXHAUST GASES
FUEL GAS
SHALE GAS
Continuous cryopump with a method for removal of solidified gases, 15:3141 (P;US)
Gas velocity measurements in purged port posting systems, 15:3124 (R;GB)
Gasification of solid fuels in energy management of industry, 15:2030 (R;FI;In Finnish)
Method for measuring the effectiveness of gaseous-contaminant removal filters, 15:3257 (R;US)
On the topic of single and multicomponent chemisorption isotherms, 15:2092 (R;US)

GASOLINE ENGINES
See INTERNAL COMBUSTION ENGINES

GASTEROPODS
See MOLLUSCS

GASTRIN
Gastrin labelled at IPEN-CNEN/SP-Brazil. Comparison with a commercial tracer, 15:3104 (R;BR)
Quality control of radioimmunoassay technique for gastrine dosage, 15:3622 (R;BR;In Portuguese)

GASTROINTESTINAL TRACT
See also STOMACH
Gastric response to methyl methacrylate vapor. Progress report, 15:3769 (R;US)

GATING CIRCUITS
Bias and oxide thickness dependence of trapped-charge buildup in MOS (metal oxide semiconductors) devices. Technical report, 15:3222 (R;US)

GAUGE INVARIANCE
Extended local gauge invariance and the BRS symmetry in stochastic quantization of gauge fields, 15:4043 (R;JP)

GAUGE TRANSFORMATIONS
See GAUGE INVARIANCE

GENE LOCI
See GENES

GENERAL RELATIVITY THEORY
Hydromagnetic space-time, 15:4284 (RA;DE;In German)

GENERATORS (PULSE)
See PULSE GENERATORS

GENERATORS (STEAM)
See STEAM GENERATORS

GENES
Cloning and characterization of the recA gene of Aquaspirillum magnetotacticum, 15:3610 (R;US)
Genetic engineering of single-domain magnetic particles. Progress report, 1 March-15 June 1989, 15:3611 (R;US)
Mapping and ordered cloning of the human X chromosome: Progress report, November 1988–October 1989, 15:3603 (R;US)

GENETIC ENGINEERING
Cloning and characterization of the recA gene of Aquaspirillum magnetotacticum, 15:3610 (R;US)
Genetic engineering of single-domain magnetic particles. Progress report, 1 March-15 June 1989, 15:3611 (R;US)

GENETIC MAPPING
Molecular biology and physiology of methanogenic archaebacteria. Annual report, July 1988-June 1989, 15:3596 (R;US)

GENETICS
Genetic-activity profiles and hazard assessment, 15:3768 (R;US)

GEOCHEMISTRY
The EQ3/6 software package for geochemical modeling: Current status, 15:2238 (R;US)

GEOLOGIC FRACTURES
Analysis of natural fractures observed by borehole video camera in a horizontal well, 15:2140 (BA;US)
Analytical models for C-14 transport in a partially saturated, fractured, porous media, 15:2209 (R;US)
VSP [Vertical Seismic Profiling] and cross hole tomographic imaging for fracture characterization, 15:3812 (R;US)

GEOMAGNETIC EQUATOR
Solar diurnal variation in the amplitude of sudden commencements of magnetic storms at the geomagnetic equator, 15:3885 (R;US)

GEOMAGNETIC STORMS
See MAGNETIC STORMS

GEORGES BANK
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices, 15:2131 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 1. Final executive summary, 15:2129 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices, 15:2131 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2, 15:2130 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 1. Final executive summary, 15:2129 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2, 15:2130 (R;US)

GEOTHERMAL ENERGY
Geothermal direct use projects in the United States: Status and trends, 15:2357 (R;US)
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 2, Appendices A through E, 15:2356 (R;US)

GEOTHERMAL FLUIDS
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 1, Text and main figures, 15:2355 (R;US)

GEOTHERMAL RESOURCES
The Ahuachapan geothermal field, El Salvador: Reservoir analysis: Volume 1, Text and main figures, 15:2355 (R;US)

GEOTHERMAL SYSTEMS
See also HOT-DRY-ROCK SYSTEMS
MAGMA SYSTEMS
Aspects of the Kalina technology applied to geothermal power production, 15:2354 (R;US)

GERMANIUM
Aspects of faceting in the study of percipitate interfaces, 15:2841 (R;US)
Semiempirical modified embedded-atom potentials for silicon and germanium, 15:3024 (J;US)
Temperature dependence of acceptor-hole recombination in germanium, 15:3012 (J;US)

Thermally and ion-induced phase formation in a Pd/Ge bilayer, 15:2882 (J;US)

GERMANIUM 70 TARGET
Results of the α-scattering on the even, stable Ge isotopes, 15:4090 (RA;DE;In German)

GERMANIUM 76
Calculation of 2ν double beta decay of ^{76}Ge, ^{82}Se, $^{128,130}Te$, 15:4137 (RA;DE)
Double beta decay matrix elements in the Germanium region, 15:4133 (R;XA)

GERMANIUM ALLOYS
Characteristics of hydrogenated amorphous silicon-germanium alloys, 15:2863 (BA;US)
Semiempirical modified embedded-atom potentials for silicon and germanium, 15:3024 (J;US)

GERMANIUM ARSENIDES
Antiphase domain boundary formation in single-crystal chalcopyrite-structure $ZnGeAs_2$ grown on GaAs, 15:3013 (J;US)

GERMS (MICROORGANISMS)
See MICROORGANISMS

GIANT CELLS
See TUMOR CELLS

GIANT RESONANCE
(e,e'f) coincidence experiments for fission decay of giant resonances in $^{235,238}U$, 15:4113 (RA;DE;In German)
Angular momentum dependence of the dipole giant resonance in hot nuclei, 15:4102 (RA;DE;In German)

GLASS
See also BOROSILICATE GLASS
Acoustic studies of new materials: Quasi crystals, low-loss glasses, and high tc superconductors. Annual summary report, 1 October 1988-30 September 1989, 15:2901 (R;US)
Comment on "Speckle in the diffraction patterns of Hendricks-Teller and icosahedral glass models", 15:4241 (J;US)
Natural analogue study of volcanic glass. A case study of basaltic glasses in pyroclastic fall deposits of Fuji volcano, Japan, 15:3804 (R;JP)
Y-Si-Al-O-N glass fibers. Final report, 15:2967 (R;US)

GLAUBER'S SALT
See SODIUM SULFATES

GLAZING
Short-time-scale measurements of fenestration thermal performance under realistic springtime conditions, 15:2343 (BA;US)

GLAZING MATERIALS
Determination and application of bidirectional solar-optical properties of fenestration systems, 15:2335 (BA;US)

GLUCAGON
Rapid method for purification of radioiodinated glucagon, 15:3623 (R;BR;In Portuguese)
Rapid purification of radiodinated glucagon with Sep-Pak^R reversed phase cartridges, 15:3621 (R;BR)

GLUEBALLS
Status of glueball mass calculations in lattice gauge theory, 15:3986 (R;US)

GLUON MODEL
Meteorite tracking network, 15:4151 (RA;DE;In German)

GLUONIUM
See GLUEBALLS

GLUONS
One-jet inclusive cross section at order α_s^3. I. Gluons only, 15:4011 (J;US)
Search for supersymmetric particles at CDF, 15:3974 (R;US)

GOBAR GAS
See METHANE

GOLD
Phonon dispersion measurements and first-principles calculations for the Au(110) surface, 15:2895 (J;US)
The influence of adsorbate–absorbate hydrogen bonding in molecular chemisorption: NH_3, HF, and H_2O on Au(111), 15:3094 (J;US)
Theoretical study of noble-metal (100) surface reconstructions using first-principles techniques, 15:2877 (J;US)
Thermodynamic properties of fcc transition metals as calculated with the embedded-atom method, 15:2883 (J;US)

GOLD 194 TARGET
Search for the quark-gluon plasma (1989): The NA35 experiment at the CERN SPS, 15:4066 (R;US)

GOLD 197 TARGET
Relativistic heavy ion research: Progress report, November 15, 1988–November 14, 1989, 15:4108 (R;US)

GOLD 198
Falling-sphere radioactive viscometry, 15:3190 (R;BR;In Portuguese)
Radioactive colloid gold ^{198}Au in combined treatment of lung cancer, 15:3674 (RA;SU;In Russian)

GOLD ALLOYS
Ion-beam mixing and amorphization in Au/Zr bilayers, 15:2859 (BA;US)

GRADED LIE GROUPS
N=2 superconformal symmetry and SO(2,1) current algebra, 15:4025 (J;NL)

GRAIN BOUNDARIES
Quasicrystals and grain boundaries, 15:2823 (R;US)

GRAINS (CEREAL)
See CEREALS
SEEDS

GRANULAR BED FILTERS
Investigations on combined deposition of particulate and gaseous pollutants in a packed bed filter at high temperatures, 15:2730 (R;DE;In German)

GRAPHITE
Detection of fine pore structures in graphite by impregnation with Wood's metal, 15:2978 (R;GB)
Graphite as a plasma-facing material in fusion experiments, 15:4389 (R;US)
[Graphite and carbon/carbon composition]: Foreign trip report, September 17, 1988–September 28, 1988, 15:2979 (R;US)

GRAPHITE MODERATOR
See GRAPHITE

GRAVIMETRY
Possible measurement of the gravitational acceleration of molecules, atoms, nuclei, elementary particles and antiparticles, 15:3958 (R;JP)

GRAVITATION
Comparisons of two-phase microgravity calculations using current and new flow regime maps in RELAP5, 15:3209 (J;US)
Origin of the universe from Quantum Chaos: An introduction to current ideas (professor John Dyer Memorial Lecture). Technical report, 15:3820 (R;US)
Testing the inverse-square law of gravity: Error and design with the upward continuation integral, 15:3877 (J;US)

GRAVITATIONAL FIELDS
(2+1)-dimensional quantum gravity, 15:4287 (R;JP)

GRAVITATIONAL RADIATION
Gravitational radiation from primordial solitons and soliton-star binaries, 15:4292 (J;US)

GREASES
Lubricants and greases: Properties and evaluation. January 1973-April 1988 (Citations from Fluidex data base). Report for January 1973-April 1988, 15:3135 (R;US)
Lubricants and greases: Properties and evaluation. May 1988-September 1989 (Citations from Fluidex data base). Report for May 1988-September 1989, 15:3136 (R;US)

GREAT BRITAIN
See UNITED KINGDOM

GREEN FUNCTION
Generalized relations among *N*-dimensional Coulomb Green's functions using fractional derivatives, 15:4294 (J;US)

GREENHOUSE EFFECT
Carbon dioxide and climate: Summaries of research in FY 1989, 15:3409 (R;US)
Greenhouse gas emission coefficients from the energy system. Two methods to calculate national CO_2-e issions, 15:2599 (B;NL)
Ozone depletion, greenhouse gases, and climate change, 15:3429 (R;US)

[Discussions of global environmental problems]: Foreign trip report, October 14, 1989–October 21, 1989, 15:3426 (R;US)
[The cause of the glacial to interglacial atmospheric CO_2 change]: Foreign trip report, October 14, 1989–October 24, 1989, 15:3424 (R;US)
[The role of oceans in determining atmospheric CO_2]: Foreign trip report, October 14, 1989–October 22, 1989, 15:3425 (R;US)

GREENLAND
Report for the period 1 July 1988–30 June 1989 from the Mineral Resources Administration in Greenland, 15:2600 (R;DK;In Danish)

GRENOBLE REACTOR
Conversion feasibility studies for the Grenoble high flux reactor, 15:2458 (R;US)

GROSS-NEVEU MODEL
See LAGRANGIAN FIELD THEORY

GROUND DISPOSAL
Best demonstrated available technology (BDAT) background document for K009 and K010, 15:2768 (R;US)
Best demonstrated available technology (BDAT) background document for K011, K013, and K014. Final report, 15:2769 (R;US)
Best demonstrated available technology (BDAT) background document for K043. Final report, 15:2771 (R;US)
Best demonstrated available technology (BDAT) background document for cyanide wastes, 15:2770 (R;US)
Best demonstrated available technology (BDAT) background document for organophosphorous wastes, 15:2766 (R;US)
Best demonstrated available technology (BDAT) background document for phthalate wastes, 15:2767 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:2772 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:2773 (R;US)
Methodology for developing best demonstrated available technology (BDAT) treatment standards, 15:2765 (R;US)
Response to capacity-related comments submitted on the Second Third proposed land disposal restrictions rule, 15:3520 (R;US)
Response to comments: Background document for the second third-land disposal restrictions proposed rule: Policy-related comments, 15:3518 (R;US)
Response to the Second Third wastes treatment standards: Related comments for the Second Third land-disposal restrictions proposed rule (Issue Numbers 1 through 12), 15:3519 (R;US)

GROUND MOTION
Earthquake strong ground motion studies at the Idaho National Engineering Laboratory, 15:3807 (R;US)
Ground motion measurements at the 1 - 2 GeV synchrotron radiation source site, 15:3299 (R;US)

GROUND WATER
Acidification
Water resources data for Wisconsin, Water Year 1988. Water-data report (Annual), 1 October 1987-30 September 1988, 15:3559 (R;US)

Contamination
Evaluation of the ground-water contaminant plume extending from the 183-H Solar Evaporation Basins, 15:2225 (R;US)
Soil water and vegetation management for cleanup of selenium contaminated soils: Progress report, 15:3498 (R;US)

Flow Rate
Predicting flow through low-permeability, partially saturated, fractured rock: A review of modeling and experimental efforts at Yucca Mountain, 15:2234 (R;US)

Pollutants
Distribution of heavy metals and anions in the groundwater of quaternary gravel deposits in the Munich area (Dornach). Laboratory and field test results, 15:3540 (R;DE;In German)

Recharge
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report, 15:3573 (R;US)
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report, 15:3574 (R;US)

Research Programs
Ground-water research: Technical-Assistance Directory, 15:3575 (R;US)

Sampling
Phase 1 spring and seep report: Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri: Revision 0, 15:2242 (R;US)

Water Pollution
Establishment of a Ground Water Research Data Center for validation of subsurface flow and transport models. Final report, August 1986-November 1988, 15:3557 (R;US)
Installation-Restoration Program Stage 3. McClellan AFB, California. Remedial investigation/feasibility study ground-water sampling and analysis program, January through March 1989 data summary. Final report, January-March 1989, 15:3542 (R;US)
Performance testing of Method 1312. QA (quality assurance) support for RCRA (Resource Conservation and Recovery Act) testing: Project report, 15:3583 (R;US)
Superfund Record of Decision (EPA Region 3): Croyden TCE Spill, PA. (First Remedial Action), December 1988, 15:3586 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)
Superfund Record of Decision (EPA Region 5): Wausau Water Supply, WI. (First Remedial Action), December 1988, 15:3587 (R;US)
Use of ground-penetrating radar to define recharge areas in the Central Sand Plain. Technical completion report, 15:3560 (R;US)

Water Pollution Abatement
Ground water protection efforts in four new england states. Technical report, 15:3588 (R;US)

Water Pollution Control
Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly, 15:3580 (R;US)
Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly. Appendix 2. Written comments, 15:3581 (R;US)

Water Quality
Regulatory requirements for groundwater monitoring networks at hazardous waste sites, 15:3501 (R;US)

Water Treatment
Water treatment: Air stripping. December 1981-July 1989 (Citations from the Selected Water Resources Abstracts data base). Report for December 1981-July 1989, 15:3562 (R;US)

GROUND-WATER RESERVES
See AQUIFERS

GROUNDWATER RECHARGE
See RECHARGE

GROUP THEORY
Minimal prime ideals in semigroups without nilpotent elements, 15:4278 (R;XA)
On pure radical in semigroups with zero, 15:4274 (R;XA)

GROUTING
Rheological measurements on cement grouts, 15:2177 (R;GB)

GUANINE
ESR and ENDOR studies of X-irradiated single crystals of guanine derivatives, 15:3708 (RA;DE)
Free radicals formation in nucleosides and nucleotides of guanine: ESR and ENDOR of guanosine 5'-monophosphate and guanosine: Di-methylformamide X-irradiated at 10 K, 15:3717 (RA;DE)

GUARDS
See SECURITY PERSONNEL

H

H CODES
A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation, 15:2541 (R;US)

HADRON-HADRON INTERACTIONS
One-jet inclusive cross section at order α_s^3. I. Gluons only, 15:4011 (J;US)
Towards a unification of the geometrical, stochastic and dynamical properties of hadronic matter in collision, 15:3980 (R;US)

HADRONIC ATOMS
Light kaonic and antiprotonic atoms, 15:3893 (R;GB)

HADRONS
See also BARYONS
Hadronization of the flux tubes in ultrarelativistic nucleus–nucleus collisions, 15:4167 (J;US)
Phenomenological hadron form factors and finite size of chiral solitons, 15:3999 (RA;DE)
Research in theoretical physics: Technical progress report, 15:4033 (R;US)

HAFNIUM 154
The study of exotic N $\simeq$ 82 nuclei using the Daresbury recoil mass separator, 15:4101 (R;US)

HAFNIUM 178
Calculation of the production cross sections of high-spin isomeric states in hafnium, 15:4429 (R;US)

HAFNIUM 179
Calculation of the production cross sections of high-spin isomeric states in hafnium, 15:4429 (R;US)

HAFNIUM NITRIDES
Aspects of faceting in the study of percipitate interfaces, 15:2841 (R;US)

HALDEN HEAVY BOILING WATER REACTOR
See HBWR REACTOR

HALLEY COMET
The neutral gas-mass-spectrometer onboard the GIOTTO-probe to Comet Halley, 15:3821 (RA;DE;In German)

HALOGENATED ALIPHATIC HYDROCARBONS
See also CHLORINATED ALIPHATIC HYDROCARBONS
FLUORINATED ALIPHATIC HYDROCARBONS
FREONS
IODINATED ALIPHATIC HYDROCARBONS
Validation and application of pharmacokinetic models for interspecies extrapolations in toxicity risk assessments of volatile organics. Annual report No. 2, 1 July 1988-30 June 1989, 15:3757 (R;US)

HAMILTON-JACOBI EQUATIONS
Symplectic numerical integration of Hamiltonian systems, 15:4286 (R;US)

HANDLING (DATA)
See DATA PROCESSING

HANDLING (MATERIALS)
See MATERIALS HANDLING

HANDLING (WASTES)
See WASTE MANAGEMENT

HANFORD ATOMIC PRODUCTS OPERATION
See HAPO

HANFORD PRODUCTION REACTORS
Integrated computer-based tools to facilitate environmental monitoring, assessment, and restoration, 15:2598 (R;US)
Preliminary report, KW reactor incident, 15:2527 (R;US)

HANFORD RESERVATION
Environmental monitoring for radionuclides, chemicals, fish and wildlife at a US energy research facility: A case story, 15:3751 (R;US)
Strontium-90 in Canada goose eggshells: Non-fatal monitoring for contamination in wildlife, 15:3515 (R;US)

HAPO
Radiological Sciences Department Annual report: Research and development, Fiscal year 1955, 15:3504 (R;US)
Radiological Sciences Department annual report, research and development, fiscal year 1954, 15:3503 (R;US)

HARMONIC OSCILLATORS
Dirac-Fock calculations in multi-harmonic-oscillator basis, 15:4507 (R;FR;In French)

HAYNES 188 ALLOY
Preliminary study of creep thresholds and thermomechanical response in Haynes 188 at temperatures in the range 649 to 871 C, 15:2844 (RA;US)

HAZARDOUS MATERIALS
Best demonstrated available technology (BDAT) background document for organophosphorous wastes, 15:2766 (R;US)
Detection of genetic hazards from environmental chemicals with plant test systems, 15:3776 (R;US)

Acrylonitrile
Best demonstrated available technology (BDAT) background document for K011, K013, and K014. Final report, 15:2769 (R;US)

Arsenic Compounds
Reduction of arsenic wastes in the electronics industry (application to study). Final report, 15:2748 (R;US)

Asbestos
Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)
Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados, 15:3459 (R;US)

Carcinogens
EPA (Environmental Protection Agency) programs and the regulation of carcinogens: Methods and philosophies. Technical report, 15:3786 (R;US)

Catalogs
Hints and search strategies for the substances listed in the Accident Ordinance, 15:3803 (R;DE;In German)

Chlorinated Aliphatic Hydrocarbons
Best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:2773 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:2772 (R;US)

Chloroform
Best demonstrated available technology (BDAT) background document for K009 and K010, 15:2768 (R;US)

Cyanides
Best demonstrated available technology (BDAT) background document for cyanide wastes, 15:2770 (R;US)

Dusts
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)

Ground Release
Development of a hazardous materials dispersion modeling capability with application to ambient air monitoring network design: Project plan, 15:3465 (R;US)
In situ optical measurements of hydrofluoric acid aerosols, 15:3469 (R;US)

Health Hazards
Methods used in the United States for the assessment and management of health risk due to chemicals, 15:3773 (R;US)

Information Dissemination
Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication, 15:3684 (R;US)

Mass Transfer
The Pacific Basin Consortium: A new device for problems without borders, 15:3496 (R;US)

Occupational Safety
National Institute for Occupational Safety and Health (NIOSH): Health Hazard Evaluation Reports. January 1987-September 1989 (Citations from the NTIS data base). Report for January 1987-September 1989, 15:3685 (R;US)

Organic Compounds
Steam stripping and batch distillation for the removal/recovery of volatile organic compounds, 15:2736 (R;US)

Organic Nitrogen Compounds
Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene,

toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)

Organic Solvents
Reduction of solvent wastes in the electronics industry. Waste reduction grant program. Final report, 15:2749 (R;US)

Paints
Waste audit study: Automotive paint shops, 15:2744 (R;US)

Performance Testing
Trial burns: methods perspective, 15:2763 (R;US)

Pesticides
Best demonstrated available technology (BDAT) background document for K043. Final report, 15:2771 (R;US)

Phthalates
Best demonstrated available technology (BDAT) background document for phthalate wastes, 15:2767 (R;US)

Preservatives
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Wood-treating industries, 15:2737 (R;US)

Production
The generation and control of hazardous waste in the Pacific Basin, 15:3497 (R;US)

Public Information
The Hazardous Materials Information Exchange: An electronic bulletin board for the emergency response community, 15:3494 (R;US)

Radioactive Waste Disposal
Training waste generators: The first responder in proper waste management, 15:2184 (R;US)

Risk Assessment
Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)
Supplemental risk-assessment guidance for the Superfund program. Part 1. Guidance for Public-Health Risk Assessments. Part 2. Guidance for ecological Risk Assessments. Draft report (Final), 15:3582 (R;US)

Sanitary Landfills
Performance testing of Method 1312. QA (quality assurance) support for RCRA (Resource Conservation and Recovery Act) testing: Project report, 15:3583 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)

Silica
Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey, 15:3456 (R;US)

Smokes
Health-hazard evaluation report HETA 87-109-1950, North Riverside Fire Department, North Riverside, Illinois, 15:3458 (R;US)

Styrene
In-depth industrial-hygiene survey report on styrene exposure at Fiberform, Spokane, Washington, January 16-18, 1979, 15:3433 (R;US)
In-depth industrial-hygiene survey report on styrene exposure at Larson Industries, Incorporated Boat Plant, Little Falls, Minnesota, February 27-March 1, 1979, 15:3434 (R;US)

Toluidines
Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)

Transportation Systems
Hazardous-materials transportation. September 1982-September 1989 (Citations from the COMPENDEX data base). Report for September 1982-September 1989, 15:2715 (R;US)

Waste Disposal
Applicable or relevant and appropriate requirements (ARARs) for radioactive mixed waste, 15:2228 (R;US)
Application of a simple short-term bioassay for the identification of genotoxins from hazardous wastes, 15:3782 (R;US)
Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report, 15:2195 (R;US)
Incinerability index: A measure of incinerator performance, 15:2743 (R;US)
Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska, 15:2717 (R;US)
Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska, 15:2716 (R;US)
Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska, 15:2721 (R;US)
Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska, 15:2723 (R;US)
Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska, 15:2722 (R;US)
Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska, 15:2720 (R;US)
Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska, 15:2719 (R;US)
Installation-Restoration Program Preliminary Assessment, Naknek Recreational Camps, Alaska, 15:2718 (R;US)
ROD (Record of Decision) annual report, FY 1988, 15:3590 (R;US)
Regulatory requirements for groundwater monitoring networks at hazardous waste sites, 15:3501 (R;US)
Response to capacity-related comments submitted on the Second Third proposed land disposal restrictions rule, 15:3520 (R;US)
Response to comments: Background document for the second third-land disposal restrictions proposed rule: Policy-related comments, 15:3518 (R;US)
Safe disposal of hazardous wastes: The special needs and problems of developing countries. Volume 1-Volume 3. World Bank technical paper, 15:2750 (R;US)
Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report, 15:3527 (R;US)
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988, 15:3526 (R;US)
Superfund Record of Decision (EPA Region 2): Ciba-Geigy, NJ. (First Remedial Action), April 1989, 15:3530 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989, 15:3534 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 3): Wildcat Landfill, DE. (Second Remedial Action), November 1988. Final report, 15:3535 (R;US)
Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988, 15:3533 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report, 15:3523 (R;US)
Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report, 15:3528 (R;US)
Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report, 15:3532 (R;US)

Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988, 15:3524 (R;US)
Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988, 15:3500 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)
Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988, 15:3529 (R;US)
Technology transfer in hazardous waste management, 15:2185 (R;US)
The generation and control of hazardous waste in the Pacific Basin, 15:3497 (R;US)
Uncontrolled hazardous waste site cleanup programs in the US: An overview, 15:3495 (R;US)

Waste Management
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Analytical laboratories, 15:2740 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Dry cleaners and commercial laundries, 15:2739 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Printing and publishing, 15:2738 (R;US)
Turning off the tap: Strategies for hazardous waste minimization in the city of Los Angeles, 15:2776 (R;US)
Waste audit study: Automotive paint shops, 15:2744 (R;US)
Waste audit study: Research and educational institutions, 15:2746 (R;US)

Waste Processing
Methodology for developing best demonstrated available technology (BDAT) treatment standards, 15:2765 (R;US)
Response to the Second Third wastes treatment standards: Related comments for the Second Third land-disposal restrictions proposed rule (Issue Numbers 1 through 12), 15:3519 (R;US)
Treatment technology background document, 15:2764 (R;US)

Water Pollution
Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988, 15:3500 (R;US)

HAZARDOUS MATERIALS SPILLS
Superfund Record of Decision (EPA Region 3): Croyden TCE Spill, PA. (First Remedial Action), December 1988, 15:3586 (R;US)

HBWR REACTOR
[Halden Reactor Project and DOE's Advanced Controls Program: Foreign trip report, October 16, 1989–October 22, 1989, 15:2481 (R;US)

HCDA
See REACTOR CORE DISRUPTION

HD 8077
See NICKEL BASE ALLOYS

HDO
See DEUTERIUM COMPOUNDS
HEAVY WATER

HEALTH HAZARDS
See also RADIATION HAZARDS
A review of the literature on the toxicity of rare-earth metals as it pertains to the Engineering Demonstration System surrogate testing, 15:3792 (R;US)
Bounding dispersion analysis for rare-earth elements as it pertains to the Engineering Demonstration System surrogate testing, 15:3752 (R;US)
Environmental considerations for the conduct of surrogate tests in the Engineering Demonstration System, 15:3791 (R;US)
Methods used in the United States for the assessment and management of health risk due to chemicals, 15:3773 (R;US)
National Institute for Occupational Safety and Health (NIOSH): Health Hazard Evaluation Reports. January 1987-September 1989 (Citations from the NTIS data base). Report for January 1987-September 1989, 15:3685 (R;US)
Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication, 15:3684 (R;US)
Trends in radionuclide concentrations for wildlife and food products near Hanford for the period 1971 through 1988, 15:2232 (R;US)

HEALTH PHYSICS
See RADIATION PROTECTION

HEAT CAPACITY
See SPECIFIC HEAT

HEAT ENGINES
See also INTERNAL COMBUSTION ENGINES
Solid lubrication of ceramic sufraces by IAD [ion-assisted deposition]-silver coatings for heat engine applications, 15:2906 (R;US)

HEAT EXCHANGERS
Heat transfer and pressure drop measurements in an air/molten salt direct-contact heat exchanger, 15:2337 (BA;US)
High-temperature corrosion of heat exchanger materials, 15:2911 (R;US)
Jet instabilities in liquid-liquid systems. Application to direct contact heat exchangers, 15:3188 (R;FR;In French)

HEAT PUMPS
See also WATER SOURCE HEAT PUMPS
Development of high-efficiency scroll compressors for air conditioners, 15:2695 (R;JP)
Diesel-driven heat pump applied to grain drying and chilling. Phase 2, 15:2734 (R;DK;In Danish)
Noise pollution abatement for heat pumps with internal combustion engines. Illustrated by the large-capacity gas-fueled heat pumps in domestic and commercial buildings, 15:2675 (R;DE;In German)

HEAT RESISTING ALLOYS
See also ALLOY-FE46NI33CR21
ALLOY-NI59CR30FE9
ALLOY-NI76CR15FE8
High temperature constitutive and crack initiation modeling of coated single crystal superalloys, 15:2845 (RA;US)

HEAT SINKS
Thermal evaluation of advanced solar dynamic heat receiver performance. Final report, January-December 1988, 15:2320 (R;US)

HEAT SOURCES (RADIOISOTOPE)
See RADIOISOTOPE HEAT SOURCES

HEAT STORAGE
See also LATENT HEAT STORAGE
SEASONAL THERMAL ENERGY STORAGE
Thermal energy storage. July 1987-September 1989 (Citations from the NTIS data base). Report for July 1987-September 1989, 15:2566 (R;US)

HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT TRANSFER
See also CONVECTION
Are the external heat transfer coefficients correct?, 15:2680 (R;DE;In German)
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1, 15:2215 (R;US)
Some heat transfer problems with phase change processes. Numerical and experimental analysis, 15:3191 (R;SE)
Strong source heat transfer simulations based on a GalerKin/Gradient - least - squares method, 15:3194 (R;BR)
Three-dimensional modeling of heat transfer from slab floors. Final report, 15:2661 (R;US)

HEAT TRANSMISSION
See HEAT TRANSFER

HEATING SYSTEMS
See also SOLAR HEATING SYSTEMS
A study of aggregation bias in estimating the market for home heating and cooling equipment, 15:2687 (R;US)
Computer-aided analysis of heating pipe networks, 15:2681 (R;DE;In German)

Market share elasticities for fuel and technology choice in home heating and cooling, 15:2685 (R;US)

HEAVY ION ACCELERATORS
See also BROOKHAVEN RHIC
A raster scanning power supply system for controlling relativistic heavy ion beams at the Bevalac biomedical facility, 15:3280 (BA;US)
Beam dynamical studies of cryring. Quarterly report 3. quarter 1987, 15:3325 (R;FI)

HEAVY ION REACTIONS
See also ARGON 40 REACTIONS
CARBON 12 REACTIONS
IRON 56 REACTIONS
LITHIUM 7 REACTIONS
MAGNESIUM 24 REACTIONS
MOLYBDENUM 100 REACTIONS
MOLYBDENUM 98 REACTIONS
NICKEL 58 REACTIONS
OXYGEN 16 REACTIONS
OXYGEN 18 REACTIONS
SILICON 28 REACTIONS
SODIUM 23 REACTIONS
SULFUR 32 REACTIONS
SULFUR 34 REACTIONS
SULFUR 36 REACTIONS
TIN 120 REACTIONS
ZIRCONIUM 90 REACTIONS
Coulomb-nuclear interference in elastic heavy-ion scattering, 15:4166 (J;NL)
Feynman–Monte Carlo calculations of electron capture at relativistic collider energies, 15:4176 (J;US)
Hydrodynamics in high-energy nuclear collisions. Quarterly report 3. quarter 1987, 15:4004 (R;FI)
Microscopic description of heavy ion reactions in the Fermi energy domain, 15:4149 (RA;DE)
Nuclear fragmentation energy and momentum transfer distributions in relativistic heavy-ion collisions. Progress report, period ended 30 June 1989, 15:4163 (R;US)
Temporal development of the plasma phase transition, 15:4242 (J;US)

HEAVY IONS
Theory of RBE: Annual progress report, January 1, 1989–December 31, 1989, 15:3617 (R;US)

HEAVY LEPTONS
See also TAU PARTICLES
Search for unstable heavy neutral leptons in e^+e^- annihilations at $\sqrt{s}$ from 50 to 60.8 GeV, 15:3970 (J;US)

HEAVY OILS
See PETROLEUM
VISCOSITY

HEAVY WATER
Cluster-impact fusion, 15:4240 (J;US)
The reactions of iron clusters with water, 15:3091 (J;US)

HEAVY WATER COOLANT
See HEAVY WATER

HEAVY WATER MODERATOR
See HEAVY WATER

HELIOSPHERE
Current models of the intensely ionizing particle environment in space, 15:3853 (RA;US)
Particles accelerated by shocks in the heliosphere, 15:3859 (RA;US)
The radial dependence of the solar energetic particle flux, 15:3856 (RA;US)
Toward a descriptive model of galactic cosmic rays in the heliosphere, 15:3852 (RA;US)
Toward a descriptive model of solar particles in the heliosphere, 15:3851 (RA;US)

HELIOTRON
Biased limiter experiment in the Heliotron E device, 15:4441 (R;JP)
Density clamping phenomena in electron cyclotron resonance heated plasmas on Heliotron E, 15:4344 (R;JP)
Proceedings of US-Japan workshop on new generation experiments and reactors (joined by EC), 15:4440 (R;JP)
STEP code improvements and extensions, 15:4346 (R;JP)
Second harmonic electron cyclotron heating in low and over density plasmas in Heliotron DR, 15:4347 (R;JP)
Study on edge plasma physics and particle control in the Heliotron E device, 15:4343 (R;JP)

HELIUM
Absolute differential cross sections for small-angle H^+-He direct and charge-transfer scattering at keV energies, 15:3918 (J;US)
Comparison of single-electron removal processes in collisions of electrons, positrons, protons, and antiprotons with hydrogen and helium, 15:3910 (J;US)
Experimental and theoretical study of two center electron emission in 25-MeV/u Mo^{40+} + He collisions, 15:4071 (R;FR)
Mixing of gases in large volumes by forced injection, 15:3155 (R;US)
Single and double ionization of helium by hydrogen-atom impact, 15:3921 (J;US)
Spectral characteristics of arc-heated low density plasma flows (3). Helium plasma, 15:3892 (R;JP;In Japanese)

HELIUM 3 REACTIONS
Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures, 15:4082 (J;NL)

HELIUM 4 REACTIONS
See ALPHA REACTIONS

HELIUM 4 TARGET
$^4He(e,e'c)$ coincidence experiments for investigation of charge symmetry in ^4He, 15:4072 (RA;DE;In German)

HELIUM IONS
Radiative and nonradiative charge transfer in He^++H collisions at low energy, 15:3913 (J;US)
Treatment planning for stereotactic heavy-charged particle radiosurgery of the brain, 15:3677 (R;US)

HELIUM METHOD
See ISOTOPE DATING

HEMORRHAGE
Diagnostic possibilities of MR-tomography in revealing and evaluation of hematoma state, 15:3626 (RA;SU;In Russian)

HEPATOCYTES
See LIVER CELLS

HEREDITY
See GENETICS

HETEROJUNCTIONS
Magnetoquantum oscillations of the phonon-drag thermoelectric power in heterojunctions, 15:4245 (J;US)

HFBR REACTOR
Tensile and impact testing of an HFBR [High Flux Beam Reactor] control rod follower, 15:2457 (R;US)

HFIR REACTOR
Job/task analysis for I&C [Instrumentation and Controls] instrument technicians at the High Flux Isotope Reactor, 15:2492 (R;US)

HIGGS BOSONS
90-GeV Higgs boson in supersymmetric models, 15:4024 (R;GB)
Corrections to Higgs-boson-mass sum rules from the sfermion sector of a supersymmetric model, 15:4030 (J;US)
How to study longitudinal *W*s in the TeV region, 15:4012 (J;US)
Using the hadronic multiplicity to distinguish real *W*s from QCD jet backgrounds, 15:4059 (J;US)
When is a heavy quark not a parton? Charged Higgs production and heavy quark mass effects in the QCD-based parton model, 15:3983 (R;US)

HIGGS MODEL
Low-energy lepton violation from supersymmetric flipped SU(5), 15:4031 (J;US)

HIGH ALTITUDE (STRATOSPHERE)
See STRATOSPHERE

HIGH BTU GAS
Advanced gasifier-desulfurizer process development for SNG (substitute natural gas) application. Final report, August 1987-December 1988, 15:2047 (R;US)

Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report, 15:2143 (R;US)

HIGH ENERGY PHYSICS
Experimental investigations in particle physics at intermediate energies: Performance report, December 1, 1988–December 31, 1989, 15:3951 (R;US)
Proceedings of the Storrs meeting, 15:3942 (B;US)
Research in elementary particle physics: Progress report, March 1, 1989–February 28, 1990, 15:3944 (R;US)
The ultimate structure of matter: The US High Energy Physics Program from the 1950s through the 1980s, 15:3943 (R;US)
[Theory of elementary particles studies in weak interaction and grand unification and studies in accelerator design]: Annual report, Task A, 15:3945 (R;US)

HIGH ENERGY RADIOTHERAPY
See RADIOTHERAPY

HIGH EXPLOSIVES
See CHEMICAL EXPLOSIVES

HIGH FLUX ISOTOPE REACTOR
See HFIR REACTOR

HIGH TEMPERATURE GAS COOLED AND GRAPHITE MODERATED REACTORS
See HTGR TYPE REACTORS

HIGH-BETA PLASMA
Observation of a stable high-beta axisymmetric plasma equilibrium, 15:4382 (J;US)

HIGH-LEVEL RADIOACTIVE WASTES
Demonstration Programs
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 2, 15:2191 (R;US)
Waste Isolation Pilot Plant (WIPP) TRU waste shipment dry run preoperational checkout plan, 15:2192 (R;US)
Leaching
Static leaching of actinides and fission products from fully radioactive waste glass of HLLW generated in Tokai reprocessing plant, 15:2224 (R;JP)
Radioactive Waste Disposal
Effectiveness of interim remedial actions at a radioactive waste facility, 15:2180 (R;US)
Radioactive Waste Management
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Verification, example and benchmark problems: Volume 3, 15:2217 (R;US)
Remediation of DOE hazardous waste sites: Planning and integration requirements, 15:2243 (R;US)
Radioactive Waste Processing
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 1, 15:2190 (R;US)
Slurry-fed ceramic melter–A broadly accepted system to vitrify high-level waste, 15:2226 (R;US)
Radioactive Waste Storage
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1, 15:2215 (R;US)
FLAC (Fast Lagrangian Analysis of Continua), Version 2.20: User's manual, 15:2216 (R;US)
Predicting flow through low-permeability, partially saturated, fractured rock: A review of modeling and experimental efforts at Yucca Mountain, 15:2234 (R;US)
Underground Disposal
A kinetic model for dissolution of borosilicate glass, 15:2240 (R;US)
A sensitivity study of near-field thermomechanical conditions in tuff, 15:2227 (R;US)
Analyses of transport in the upper soil layer and interpretation of caisson experiments, 15:2202 (R;US)
Analysis of caisson transport experiments by travel time approach, 15:2201 (R;US)
Analytical models for C-14 transport in a partially saturated, fractured, porous media, 15:2209 (R;US)
Application of the results of excavation response experiments at climax and the Colorado School of Mines to the development of an experiment for the underground research laboratory, 15:2237 (R;US)
Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 15:2233 (R;US)
Evaluation of the post-emplacement environment of high level radioactive waste packages at Yucca Mountain, Nevada (Yucca Mountain project), 15:2239 (R;US)
Gas flow in and out of a nuclear waste container, 15:2211 (R;US)
Geotechnical support and topical studies for nuclear waste geologic repositories: Annual report, fiscal year 1988, 15:2208 (R;US)
Mass transport in salt repositories: Steady-state transport through interbeds, 15:2207 (R;US)
Mass transport in salt repositories: Transient diffusion into interbeds, 15:2206 (R;US)
Preliminary integrated calculation of radionuclide cation and anion transport at Yucca Mountain using a geochemical model, 15:2204 (R;US)
Release rates of soluble species at Yucca Mountain, 15:2210 (R;US)
The EQ3/6 software package for geochemical modeling: Current status, 15:2238 (R;US)
The Waste Isolation Pilot Plant (WIPP) Seal System Performance Program, 15:2236 (R;US)
VSP [Vertical Seismic Profiling] and cross hole tomographic imaging for fracture characterization, 15:3812 (R;US)
Variable temperature effects on release rates of readily soluble nuclides: Revision, 15:2205 (R;US)

HIGH-VOLTAGE PULSE GENERATORS
Fiber optic control and diagnostic family of hardwares for the Confinement Physics Research Facility (CPRF) toroidal field and dc interrupter systems, 15:4433 (R;US)
Performance of the 10kV, 100-kA pulsed-power modules for the FRX-C magnetic compression experiment, 15:4428 (R;US)

HIGHWAYS
See ROADS

HIPPOCAMPUS
Enhanced acoustic startle responding in rats with radiation-induced hippocampal granule cell hypoplasia, 15:3692 (R;US)

HODGKINS DISEASE
Modification of radiotherapy of patients with 1A-3A stage lymphogranulomatosis, 15:3646 (RA;SU;In Russian)
Use of subtotal body irradiation as the first stage of systemic antitumoral therapy of patients with generalized lymphogranulomatosis, 15:3645 (RA;SU;In Russian)

HOG FUEL
See WOOD WASTES

HOLMIUM 152
Measurement of γ angular distributions in ^{152}Dy and ^{152,153}Ho, 15:4104 (RA;DE;In German)

HOLMIUM 153
Measurement of γ angular distributions in ^{152}Dy and ^{152,153}Ho, 15:4104 (RA;DE;In German)

HOLMIUM 165 TARGET
Correlations between fragment mass and excitation energy in damped reactions, 15:4168 (J;US)

HOLMIUM COMPOUNDS
Resistivity measurements of superconducting materials. Master's thesis, 15:2932 (R;PK)

HOLOGRAPHY
Fiber-optic wavelength-division multiplexing and demultiplexing using volume holographic gratings, 15:3373 (J;US)

HOMOGENIZATION METHODS
Studies of the homogenization of structurally viscous and viscoelastic liquids in stirring containers, 15:2757 (TJ;US)

HOMOJUNCTIONS
An empirical investigation of the InP shallow-homojunction solar cell, 15:2314 (BA;US)

HORIZONTAL AXIS TURBINES
A comparison of results from dynamic-response field tests, 15:2404 (BA;US)
Aerodynamic pressure and flow-visualization measurement from a rotating wind turbine blade, 15:2402 (BA;US)
Liquid-crystal, shear-stress-visualization experiments on a horizontal axis wind turbine, 15:2403 (BA;US)

Power mesurements on a 99 kW "Smedemoelle" wind turbine, erected at Hasle, Bornholm, 15:2385 (R;DK;In Danish)

HORTICULTURE
Water hyacinth horticulture management of manure, 15:2735 (R;DK;In Danish)

HOSPITALS
Mutagenicity of combustion emissions from a biomedical-waste incinerator, 15:3774 (R;US)

HOT GAS CLEANUP
Pore structure and reactivity changes in hot coal gas desulfurization sorbents: Technical progress report, July–September 1989, 15:2067 (R;US)

HOT PLASMA
Preferential electron-cyclotron heating of hot electrons and formation of overdense plasmas, 15:4378 (J;US)

HOT WATER HEATERS
See WATER HEATERS

HOT-DRY-ROCK SYSTEMS
Reactions and interactions of the reservoir rock with heat exchange media in the hot dry rock process: A case study in the Falkenberg granite, 15:2359 (R;DE;In German)

HOUSES
Application of radon reduction methods (revised), 15:3484 (R;US)
Effect of shading devices on residential energy use in Austin, Texas. Research report, 15:2694 (R;US)
Household energy consumption and expenditures, 1987: Part 1, National data, 15:2672 (R;US)
Investigation of the indoor air quality of renovated houses in Bois-le-Duc, Netherlands, 15:2704 (R;NL;In (In Dutch))
Measuring heat flows in collective heating systems. Appendices and figures, 15:2703 (R;NL;In (In Dutch))
Measuring heat flows in collective heating systems. Illusion or reality, 15:2702 (R;NL;In (In Dutch))
Space heating performance of the ghost ranch sundwellings, 15:2334 (BA;US)
Testing of indoor radon-reduction techniques in central Ohio houses: Phase 1 (Winter 1987-1988). Report for October 1987-August 1988 (Final), 15:3485 (R;US)
The Hood River Story: How a conservation project was implemented: Volume 1, Final report, 15:2670 (R;US)

HTGR TYPE REACTORS
See also HTTR REACTOR
Study on shaft vibration of gas circulators with gas-bearings for HENDEL helium test facility, 15:2454 (R;JP;In Japanese)
[Safety related reactor physics calculation for HTGR type reactors]: Foreign trip report, October 3, 1989–October 7, 1989, 15:2455 (R;US)

HTO
See HEAVY WATER
TRITIUM COMPOUNDS

HTTR REACTOR
Stabilities of dimension and thermal-resistance of ASR-ORB carbon for thermal barrier materials of HTTR, 15:2491 (R;JP;In Japanese)

HUGENHOLTZ-PINES THEORY
See HYDROGEN

HUMAN CELLS
See ANIMAL CELLS

HUMAN FACTORS
Human Factors Regulatory Research Program Plan, FY 1989–FY 1992: Volume 1, 15:2537 (R;US)

HUMAN FACTORS ENGINEERING
Solution bias in complex systems modeling, 15:4514 (R;US)

HUMAN POPULATIONS
Ingestion of radiocesium and strontium-90 by self-suppliers and non-self-suppliers in the first year following the Chernobyl reactor accident. Data taken as a basis for derivation of secondary intervention reference levels, 15:3502 (R;DE;In German)

HUMAN X CHROMOSOME
Mapping and ordered cloning of the human X chromosome: Progress report, November 1988–October 1989, 15:3603 (R;US)

HUMANS
See HUMAN POPULATIONS

HUMIC ACIDS
Electrochemical characterization and derivatization of coal: Final technical report, September 15, 1986–September 14, 1989, 15:2059 (R;US)
Field-flow fractionation in the analysis of energy-related materials: Final report, April 1, 1986–March 31, 1989, 15:3545 (R;US)

HYBRID ELECTRIC-POWERED VEHICLES
Electric and hybrid vehicles: Technical background report for the DOE flexible and alternative fuels study, 15:2791 (R;US)

HYDRAULIC RAMS
See PUMPS

HYDRAULIC TRANSPORT
Lubricated pipelining: Stability of core-annular flow, 15:2134 (R;US)

HYDROCARBON LOGGING
See WELL LOGGING

HYDROCARBONS
See also ALKANES
ALKENES
BENZENE
BENZOPYRENE
STYRENE
TOLUENE
XYLENES
Comparison of 0600-0900 AM hydrocarbon compositions obtained from 29 cities, 15:3431 (R;US)
High-energy-density solid and liquid hydrocarbon fuels. Final report, July 1987-December 1988, 15:2120 (R;US)
Ionization yields in hydrocarbons under electron irradiation, 15:3101 (J;US)
Kinetics data base for combustion modeling: Status report, February 1, 1988–January 31, 1989, 15:3107 (R;US)
Molecular dynamics studies of aromatic hydrocarbon liquids: Progress report, March 1, 1989–February 28, 1990, 15:4211 (R;US)
Report on the Ministry of Energy's statement regarding subsection 2 of section 12 of act number 293 of 10th June 1981, on the utilization of Denmark's subterranean committee on 26th October 1988, 15:2139 (R;DK;In Danish)
Solution of reference interaction site model for mixtures of short-chain polyatomic molecules, 15:3932 (J;US)

HYDROCHLORIC ACID
Bench-scale evaluation of calcium sorbents for acid-gas emission control. Report for October 1988-March 1989, 15:3444 (R;US)
Effects of coal-derived trace species on the performance of molten carbonate fuel cells: Topical report (Progress report No. 4), 15:2657 (R;US)
Hydrogen chloride bonding on dry limestone, 15:3419 (R;DK;In Danish)
Investigations on combined deposition of particulate and gaseous pollutants in a packed bed filter at high temperatures, 15:2730 (R;DE;In German)

HYDROCYANIC ACID
Effects of atmospheric mix and toxic fumes on military performance, 15:3777 (R;US)

HYDROELECTRIC POWER
Ecological aspects of lake regulation in Northern Finland. Part 2. Geomorphology and vegetation of the littoral zone, 15:2287 (R;FI;In Finnish)
Ecological aspects of lake regulation in Northern Finland. Part 5. Regulation practices and ecological effects, 15:2290 (R;FI;In Finnish)
Ecological aspects of lake regulation in northern Finland. Part 3. Macrozoobenthos and feeding of fish, 15:2288 (R;FI;In Finnish)
Ecological aspects of lake regulation in northern Finland. Part 4. Spawning and the survival of the young fish, 15:2289 (R;FI;In Finnish)

HYDROELECTRIC POWER PLANTS
See also SMALL-SCALE HYDROELECTRIC POWER PLANTS
Jubba Environmental and Socio-economic Studies (JESS). Final report, 15:2282 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 1. Executive report. Final report, 15:2283 (R;US)

Jubba Environmental and Socio-economic Studies (JESS). Volume 2. Environmental studies. Final report, 15:2284 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 3. Socio-economic studies. Final report, 15:2285 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 4. Bibliography. Final report, 15:2286 (R;US)
Quantification of Hungry Horse Reservoir water level needed to maintain or enhance reservoir fisheries: Methods and data summary, 1983–1987, 15:2278 (R;US)

HYDROELECTRICITY
See HYDROELECTRIC POWER

HYDROFLUORIC ACID
The influence of adsorbate–absorbate hydrogen bonding in molecular chemisorption: NH_3, HF, and H_2O on Au(111), 15:3094 (J;US)

HYDROGEN
Atom-Atom Collisions
Single and double ionization of helium by hydrogen-atom impact, 15:3921 (J;US)
Atom-Molecule Collisions
Quantum state-resolved study of pure rotational excitation of CO_2 by hot atoms, 15:3933 (J;US)
Chemical Reactions
Quantum mechanical reactive scattering theory for simple chemical reactions: Recent developments in methodology and applications, 15:3077 (R;US)
Combustion Kinetics
A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation, 15:2541 (R;US)
Decomposition
Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)
Desorption
The reactions of iron clusters with water, 15:3091 (J;US)
Diffusion
Surface and bulk properties which influence ion-beam hydrogenation of silicon, 15:2852 (R;US)
Electron Collisions
Electron degradation and yields of initial products. VI. Energy spectra of subexcitation electrons in argon and molecular hydrogen, 15:3908 (J;US)
Electron-Atom Collisions
Comparison of single-electron removal processes in collisions of electrons, positrons, protons, and antiprotons with hydrogen and helium, 15:3910 (J;US)
Energy-Level Transitions
A finite temperature theory of rotationally inelastic diffraction: H_2, HD, and D_2 on Cu(100), 15:4243 (J;US)
Getters
A new polymer-based hydrogen getter, 15:2993 (BA;US)
Ion-Atom Collisions
Comparison of single-electron removal processes in collisions of electrons, positrons, protons, and antiprotons with hydrogen and helium, 15:3910 (J;US)
Coupled-channel calculations of partial capture cross sections in multiply charged ion collisions with hydrogen, 15:3924 (J;US)
Radiative and nonradiative charge transfer in He^++H collisions at low energy, 15:3913 (J;US)
Ion-Molecule Collisions
Electron removal from molecular hydrogen by fully stripped ions at intermediate energies, 15:3919 (J;US)
Impact-parameter treatment of high-velocity electron capture from diatomic molecules at fixed orientation, 15:3920 (J;US)
Test of predicted $\Delta n \geq 1$ *L*-shell dielectronic-recombination cross sections, 15:3926 (J;US)
Multi-Photon Processes
The Autler-Townes effect in hydrogen at low pressure, 15:3902 (J;US)
Permeability
Hydrogen permeability coefficient determinations for used waste drum liners, 15:2985 (R;US)
Positron-Atom Collisions
Comparison of single-electron removal processes in collisions of electrons, positrons, protons, and antiprotons with hydrogen and helium, 15:3910 (J;US)

HYDROGEN 1 MINUS BEAMS
Measurement of impurities in a volume produced H^- ion beam, 15:4426 (R;JP;In Japanese)

HYDROGEN 2
See DEUTERIUM

HYDROGEN 3
See TRITIUM

HYDROGEN CHLORIDES
See HYDROCHLORIC ACID

HYDROGEN CYANIDES
See HYDROCYANIC ACID

HYDROGEN DEUTERIDE
A finite temperature theory of rotationally inelastic diffraction: H_2, HD, and D_2 on Cu(100), 15:4243 (J;US)

HYDROGEN FLUORIDES
See HYDROFLUORIC ACID

HYDROGEN HYDROXIDES
See WATER

HYDROGEN IONS 1 PLUS
Absolute differential cross sections for small-angle H^+-He direct and charge-transfer scattering at keV energies, 15:3918 (J;US)
Comparison of single-electron removal processes in collisions of electrons, positrons, protons, and antiprotons with hydrogen and helium, 15:3910 (J;US)
Impact-parameter treatment of high-velocity electron capture from diatomic molecules at fixed orientation, 15:3920 (J;US)
Measurement of transition moments between molecular excited electronic states using the Autler-Townes effect, 15:3175 (J;US)

HYDROGEN MINUS 1 BEAMS
See HYDROGEN 1 MINUS BEAMS

HYDROGEN PRODUCTION
Hydrogen conference: Workshop proceedings, 15:2258 (R;US)

HYDROGEN SULFIDES
Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report, 15:2143 (R;US)
Desulfurization of industrial gaseous effluents. Final report, 15:2729 (R;DE;In German)
Effects of coal-derived trace species on the performance of molten carbonate fuel cells: Topical report (Progress report No. 4), 15:2657 (R;US)

HYDROLOGY
Predicting flow through low-permeability, partially saturated, fractured rock: A review of modeling and experimental efforts at Yucca Mountain, 15:2234 (R;US)

HYDRONIUM IONS
See OXONIUM IONS

HYDROXYL RADICALS
Evaluation of the rate constant for the reaction OH+H_2CO: Application of modeling and sensitivity analysis techniques for determination of the product branching ratio, 15:3087 (J;US)
The reactions of peptide peroxyl radicals in aqueous solution, 15:3732 (RA;DE)
Theoretical studies of molecular mechanisms of DNA damage induced by hydroxyl radicals, 15:3703 (RA;DE)

HYPERFRAGMENTS
See HYPERNUCLEI

HYPERNUCLEI
Study of hypernuclei via (π^+, K^+) reactions at KEK, 15:3957 (R;JP)

I

I-BEAM TYPE REACTORS
See ION BEAM FUSION REACTORS

IAEA
Members of the Agency. List of 1 September 1989, 15:4492 (R;XA)

IAEA AGREEMENTS
Agreement of 20 September 1988 between the People's Republic of China and the International Atomic Energy Agency for the application of safeguards in China, 15:2245 (R;XA)

IAEA SAFEGUARDS
Agreement of 20 September 1988 between the People's Republic of China and the International Atomic Energy Agency for the application of safeguards in China, 15:2245 (R;XA)

IBR-1
See IFR REACTOR

ICF DEVICES
Conceptual design of a 10-MJ driver for a high gain target development facility, 15:4476 (BA;US)
Design and performance of future KrF laser-fusion facilities, 15:4437 (R;US)
Kilojoule operation of the Aurora KrF ICF laser system at Los Alamos, 15:4453 (BA;US)
Laboratory microfusion facility – Neutronics and radiological safety analysis, 15:4449 (R;US)
Low density microcellular carbon foams and method of preparation, 15:3036 (P;US)
The VISTA spacecraft: Advantages of ICF for interplanetary fusion propulsion applications, 15:4475 (BA;US)

IDAHO ADVANCED TEST REACTOR
See ATR REACTOR

IDAHO NATIONAL ENGINEERING LABORATORY
Applying AI techniques to improve alarm display effectiveness, 15:2247 (BA;US)
Site characterization program at the radioactive waste management complex of the Idaho National Engineering Laboratory: Annual progress report: FY-1988, 15:2186 (R;US)

IFR REACTOR
Fission energy: The integral fast reactor, 15:2509 (R;US)
Inherent controllability in modular ALMRs, 15:2507 (R;US)
Thermal hydraulic analysis of fuel reprocessing Argon Cell accidents in the demonstration integral fast reactor, 15:2459 (R;US)

IGNITION
Laser probes of natural gas ignition chemistry. Annual report, January-December 1988, 15:2153 (R;US)

IMAGE PROCESSING
Interactive multidimensional data analysis and understanding, 15:4530 (R;US)
Method of plotting the scintigrams of high information value, 15:3635 (RA;SU;In Russian)
Scry: A distributed image handling system: Version 1.1, 15:4520 (R;US)

IMPERFECTIONS
See DEFECTS

IMPERMEABLE DRY ROCK
See HOT-DRY-ROCK SYSTEMS

IMPROVEMENT RATIO
See FORMATION DAMAGE

IMPURITIES
Ash and burn control through fishbones, 15:4302 (R;US)
Control of ash accumulation by induced-fishbones, 15:4398 (R;US)

INCIDENTS
See ACCIDENTS

INCINERATION
See COMBUSTION

INCINERATORS
A perspective on human exposure to PCDDs and PCDFs emitted form municipal waste combustors, 15:3758 (R;US)
Incinerability index: A measure of incinerator performance, 15:2743 (R;US)
Incineration studies. October 1985-September 1989 (Citations from the COMPENDEX data base). Report for October 1985-September 1989, 15:2778 (R;US)
Mutagenicity of combustion emissions from a biomedical-waste incinerator, 15:3774 (R;US)
Trial burns: methods perspective, 15:2763 (R;US)
Use of bioassay methods to evaluate incinerator emissions, 15:3440 (R;US)

INCOMPRESSIBLE FLOW
Numerical simulation of the compressible Orszag-Tang vortex. Interim report, June 1988-February 1989, 15:3935 (R;US)

INDIA
Environmental issues associated with coal-fired power plants in India, 15:2431 (J;US)
Natural background radiation and population dose distribution in India, 15:4190 (R;IN)
U, Th and K distributions inferred from regional geology and the terrestrial radiation profiles in India, 15:3505 (R;IN)

INDIAN POINT-2 REACTOR
Success/simplicity/safety/savings: SI/trip reduction at Indian point 2, 15:2558 (J;US)

INDIUM ARSENIDES
Interfacial roughness in InAs/GaAs heterostructures determined by soft x-ray reflectivity, 15:3018 (J;US)
Scaling relations for strained-layer relaxation, 15:3009 (J;US)

INDIUM IONS
Precipitation, phase transformation, and enhanced diffusion in ion-implanted silicon, 15:2997 (BA;US)

INDIUM OXIDES
Solid oxide fuel cells electrodes based on IN_2O_3-$PRrO_{1.83}$-ZrO_2, 15:2659 (R;US)

INDIUM PHOSPHIDE SOLAR CELLS
An empirical investigation of the InP shallow-homojunction solar cell, 15:2314 (BA;US)
Hybrid solar cells based on DC magnetron sputtered films of n-ITO on APMOVPE grown p-InP, 15:2317 (BA;US)

INDIUM PHOSPHIDES
Ultralow recombination velocity at $Ga_{0.5}In_{0.5}P$/GaAs heterointerfaces, 15:3005 (J;US)

INDOOR AIR POLLUTION
Application of radon reduction methods (revised), 15:3484 (R;US)
Cancer risk for radon exposure in a polluted environment: Progress report, March 1, 1989–February 28, 1990, 15:3413 (R;US)
Evaluation of airborne-asbestos concentrations before and during an O and M (operations and maintenance) activity: A case study, 15:3451 (R;US)
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)
Indoor air quality: Selected references, 15:3448 (R;US)
Lung cancer risk from inhalation of radon and other pollutants in rats: Comprehensive progress report, March 1, 1987–February 28, 1990, 15:3412 (R;US)
Method for measuring the effectiveness of gaseous-contaminant removal filters, 15:3257 (R;US)
Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey, 15:3456 (R;US)
Testing of indoor radon-reduction techniques in central Ohio houses: Phase 1 (Winter 1987-1988). Report for October 1987-August 1988 (Final), 15:3485 (R;US)

INDUSTRIAL LAUNDRIES
See LAUNDRIES

INDUSTRIAL MEDICINE
National Institute for Occupational Safety and Health (NIOSH): Health Hazard Evaluation Reports. January 1987-September 1989 (Citations from the NTIS data base). Report for January 1987-September 1989, 15:3685 (R;US)
Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication, 15:3684 (R;US)

INDUSTRIAL PARKS
Proceedings of the conference: reclamation, a global perspective, 15:2079 (R;CA)

INDUSTRIAL PLANTS
See also COAL LIQUEFACTION PLANTS
FOUNDRIES
OIL SHALE PROCESSING PLANTS
PETROLEUM REFINERIES

SYNTHETIC FUELS REFINERIES
WASTE PROCESSING PLANTS

Compliance testing of the Eglin AFB (Air Force Base) asphalt-concrete Batch Plant, Eglin AFB, Florida. Final report, 5-11 March 1989, 15:3403 (R;US)
Displacement ventilation - dimensioning of supply air flow, 15:2683 (R;FI;In Finnish)
Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)
Hints and search strategies for the substances listed in the Accident Ordinance, 15:3803 (R;DE;In German)

INDUSTRIAL RADIOGRAPHY
See also NEUTRON RADIOGRAPHY
X-RAY RADIOGRAPHY
Conduct of local dosimetry in X-ray diagnosis, 15:4197 (R;DD;In German)

INDUSTRIAL SECTOR
See INDUSTRY

INDUSTRIAL WASTES

Air Pollution Control
BACT/LAER (Best Available Control Technology/Lowest Achievable Emission Rate) Clearinghouse: A compilation of control-technology determinations. Fourth supplement to 1985 edition. Summary tables and appendices A-H, 15:3491 (R;US)

Combustion
Incineration studies. October 1985-September 1989 (Citations from the COMPENDEX data base). Report for October 1985-September 1989, 15:2778 (R;US)

Hazardous Materials
Best demonstrated available technology (BDAT) background document for K009 and K010, 15:2768 (R;US)
Best demonstrated available technology (BDAT) background document for K011, K013, and K014. Final report, 15:2769 (R;US)
Best demonstrated available technology (BDAT) background document for K043. Final report, 15:2771 (R;US)
Best demonstrated available technology (BDAT) background document for cyanide wastes, 15:2770 (R;US)
Best demonstrated available technology (BDAT) background document for organophosphorous wastes, 15:2766 (R;US)
Best demonstrated available technology (BDAT) background document for phthalate wastes, 15:2767 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:2772 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:2773 (R;US)
Methodology for developing best demonstrated available technology (BDAT) treatment standards, 15:2765 (R;US)
Reduction of arsenic wastes in the electronics industry (application to study). Final report, 15:2748 (R;US)
Reduction of solvent wastes in the electronics industry. Waste reduction grant program. Final report, 15:2749 (R;US)
Response to capacity-related comments submitted on the Second Third proposed land disposal restrictions rule, 15:3520 (R;US)
Response to comments: Background document for the second third-land disposal restrictions proposed rule: Policy-related comments, 15:3518 (R;US)
Response to the Second Third wastes treatment standards: Related comments for the Second Third land-disposal restrictions proposed rule (Issue Numbers 1 through 12), 15:3519 (R;US)
Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report, 15:3527 (R;US)
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988, 15:3526 (R;US)
Superfund Record of Decision (EPA Region 2): Ciba-Geigy, NJ. (First Remedial Action), April 1989, 15:3530 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989, 15:3534 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 3): Wildcat Landfill, DE. (Second Remedial Action), November 1988. Final report, 15:3535 (R;US)
Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988, 15:3533 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)
Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report, 15:3523 (R;US)
Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report, 15:3528 (R;US)
Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report, 15:3532 (R;US)
Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988, 15:3524 (R;US)
Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988, 15:3500 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)
Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988, 15:3529 (R;US)
Treatment technology background document, 15:2764 (R;US)

Methylene Chloride
Source characterization and control technology assessment of methylene chloride emissions from Eastman Kodak Company, Rochester, NY. Final report, July 1988-April 1989, 15:3452 (R;US)

Organic Phosphorus Compounds
Best demonstrated available technology (BDAT) background document for organophosphorous wastes, 15:2766 (R;US)

Waste Disposal
Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action, 15:3591 (R;US)

Waste Management
Wisconsin waste reduction and recovery plan, 15:2745 (R;US)

Waste Processing
Recovery of metals using aluminum displacement, 15:2741 (R;US)

Waste Water
Wastewater treatment: Chemical industry. January 1970-September 1989 (Citations from Pollution Abstracts). Report for January 1970-September 1989, 15:3563 (R;US)

Water Pollution Control
Pulping effluents: Biological treatment. January 1976-September 1989 (Citations from the Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989, 15:2752 (R;US)
Removal of oil from oil-water mixtures using selective oil filtration. Masters thesis, 15:2132 (R;US)

INDUSTRY
See also CERAMICS INDUSTRY
CHEMICAL INDUSTRY
ELECTRIC POWER INDUSTRY
FOOD INDUSTRY
METAL INDUSTRY
NATURAL GAS INDUSTRY
PETROLEUM INDUSTRY
PLASTICS INDUSTRY
PRINTING AND PUBLISHING INDUSTRY
WOOD PRODUCTS INDUSTRY
Biotechnology research and development activities in industry: 1984 and 1985. Surveys of Science Resources series, 15:3604 (R;US)
Cogeneration- and Total Energy potentials at an alternative natural gas price policy and environmental policy in the Dutch National Energy Outlook scenarios, 15:2619 (B;NL;In (In Dutch))
Gasification of solid fuels in energy management of industry, 15:2030 (R;FI;In Finnish)
Hostile intelligence threat: US technology, 15:2611 (R;US)
Waste-minimization insights for the polymer industry, 15:2742 (R;US)

INERTIAL CONFINEMENT
The Gevaltig: An inertial fusion powered manned spacecraft design for outer solar system missions, 15:2710 (R;US)

INERTIAL CONFINEMENT FUSION DEVICES
See ICF DEVICES

INFECTIVITY
Los Alamos Science: AIDS research, 15:3676 (R;US)

INFLATIONARY UNIVERSE
Designing density fluctuation spectra in inflation, 15:3878 (J;US)
Inflation and non-equilibrium dynamics, 15:3876 (J;US)
Origin of the universe from Quantum Chaos: An introduction to current ideas (professor John Dyer Memorial Lecture). Technical report, 15:3820 (R;US)

INFORMATION RETRIEVAL
Possibilities of creation of information data bank in roentgenoradiology, 15:3627 (RA;SU;In Russian)

INFORMATION SYSTEMS
A plan for administrative computing at ANL, FY 1990 through FY 1992, 15:4535 (R;US)
Directory of Japanese databases in 1989, 15:4539 (R;JP)
One-way transformation of information, 15:4549 (P;US)
Power reactor information system (PRIS). Reference and online access manual, 15:2434 (R;XA)

INHALATION EXPOSURE CHAMBERS
See EXPOSURE CHAMBERS

INHIBITORS (ENZYME)
See ENZYME INHIBITORS

INHOMOGENEOUS PLASMA
Cyclotron emission asymmetry from Kirchhoff's law in a mode-conversion layer, 15:4373 (J;US)

INORGANIC COMPOUNDS
Photoconversion of inorganics to methane. Final topical report, October 1987-February 1989, 15:2267 (R;US)

INSTANTONS
Low $_{rho}$perpendicular properties of the pomeron: Theoretical implications in QCD, 15:4047 (BA;US)

INSTRUMENTS (MEASURING)
See MEASURING INSTRUMENTS

INSULATION (THERMAL)
See THERMAL INSULATION

INTEGRATED CIRCUITS
Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering center programs, January-March 1989, with 1989 CEEE events calendar, 15:3133 (R;US)
Niobium and niobium nitride contacts on semiconducting material, 15:3233 (P;US)
The architectural ergonomics of Sandia's RHIC-II growing facility, 15:3229 (BA;US)
The radiation-hardened integrated circuit (RHIC) laboratory: Pursuit of Class 1, 15:3228 (BA;US)

INTEGRATED UTILITY SYSTEMS
See TOTAL ENERGY SYSTEMS

INTERFACES
See also SEDIMENT-WATER INTERFACES
Laser-induced interface reactions of copper thin films on sapphire substrates, 15:2878 (J;US)

INTERMEDIATE IMAGE SPECTROMETER
See MAGNETIC LENS SPECTROMETERS

INTERMEDIATE MASS NUCLEI
See also CADMIUM 122
CHROMIUM 50
CHROMIUM 52
CHROMIUM 54
COBALT 59
COBALT 60
COPPER 59
GERMANIUM 76
HAFNIUM 154
HAFNIUM 178
HAFNIUM 179
IODINE 129
IODINE 131
IRON 52
IRON 54
MANGANESE 54
MOLYBDENUM 98
MOLYBDENUM 99
NICKEL 57
SELENIUM 82
STRONTIUM 90
TECHNETIUM 99
TELLURIUM 128
TELLURIUM 130
TIN 119
TITANIUM 48
TITANIUM 50
TITANIUM 52
ZIRCONIUM 95
Calculation of β^--decay half-lives by the proton-neutron QRPA, 15:4139 (RA;DE;In German)

INTERMEDIATE VECTOR BOSONS
See also W MINUS BOSONS
W PLUS BOSONS
Z NEUTRAL BOSONS
Recent results from the CDF [Collider Detector at Fermilab] experiment at the Tevatron proton-antiproton collider, 15:3953 (R;US)
Using the hadronic multiplicity to distinguish real *W*s from QCD jet backgrounds, 15:4059 (J;US)

INTERNAL COMBUSTION ENGINES
See also DIESEL ENGINES
GAS TURBINE ENGINES
RAMJET ENGINES
SPARK IGNITION ENGINES
Ceramics for transportation engines - siren or solution, 15:2782 (R;US)
Development of thermal-resistant catalysts, 15:2795 (R;JP)
Measurements of the three components of the velocity in the intake ports of an I.C. engine, 15:2789 (B;US)
Predictability of emissions from in-use vehicles at low-ambient temperature and alternate driving cycle based on standard tests, 15:2788 (B;US)
US Marine 3rd Tank Battalion lubrication evaluation under hot ambient temperatures at Twenty-Nine Palms, California. Interim report, April-September 1988, 15:2122 (R;US)

INTERNAL CONTAMINATION
See RADIONUCLIDE KINETICS

INTERNATIONAL ATOMIC ENERGY AGENCY
See IAEA

INTERNATIONAL NUCLEAR DATA COMMITTEE
Annual progress report on nuclear data 1987, 15:4193 (R;FR)

INTERNATIONAL ORGANIZATIONS
See also IAEA
INTERNATIONAL NUCLEAR DATA COMMITTEE

International aspects of restrictions of ozone-depleting substances, 15:3462 (R;US)

INTERSECTING BEAMS
See COLLIDING BEAMS

INTERSTELLAR SPACE
Silicon chemistry in interstellar clouds, 15:3866 (R;US)

INTESTINAL ABSORPTION
Gamma-radiation affects active electrolyte transport by rabbit ileum. 2. Correlation of alanine and theophylline response with morphology, 15:3689 (R;US)

INVENTIONS
Supporting independent inventors, 15:2605 (R;US)

INVERTEBRATES
See also MOLLUSCS
Pathogenic regulation of running water macroinvertebrates: Progress report, January 1, 1989–October 15, 1989, 15:3539 (R;US)

IODINATED ALIPHATIC HYDROCARBONS
The reaction of gaseous iodoethane with silver nitrate, 15:2166 (R;US)

IODINE
Angular distribution of the photoelectron yield excited by two coherently coupled photon beams, 15:4239 (J;US)

IODINE 129
Investigations of iodine-129 in the natural environment: results and implications, 15:2241 (R;GB)

IODINE 131
Radionuclide deposition and exposure in the Federal Republic of Germany after the Chernobyl accident, 15:3746 (R;US)

IODINE COMPLEXES
A three-dimensional L^2 simulation of the photodetachment spectra of $ClHCl^-$ and IHI^-, 15:3100 (J;US)

IODINE IODIDES
See IODINE

ION BEAM FUSION REACTORS
Design studies of the APEX light ion fusion experiment, 15:4461 (BA;US)
Heavy Ion Fusion Accelerator Research (HIFAR) half-year report, October 1, 1988–March 31, 1989, 15:4438 (R;US)
Radiological dose calculations for the chamber and diode region of the light ion fusion target development facility, 15:2557 (BA;US)

ION BEAM INJECTION
The Heidelberg heavy ion postaccelerator, 15:3289 (RA;DE;In German)

ION BEAM TYPE REACTORS
See ION BEAM FUSION REACTORS

ION BEAMS
See also BERYLLIUM 9 BEAMS
HYDROGEN 1 MINUS BEAMS
LITHIUM 7 BEAMS
The Heidelberg heavy ion postaccelerator, 15:3289 (RA;DE;In German)
Trajectory analysis of low-energy and hyperthermal ions scattered from Cu(110), 15:3887 (R;US)
Ultracold ion beam, 15:3293 (RA;DE;In German)

ION EXCHANGE MEMBRANES
See MEMBRANES

ION SCATTERING ANALYSIS
Trajectory analysis of low-energy and hyperthermal ions scattered from Cu(110), 15:3887 (R;US)

ION SOURCES
A high charge state multicusp ion source, 15:3304 (R;US)
Beam current regulation of DIII-D neutral beam long pulse ion sources, 15:4415 (R;US)
Broad-beam multi-ampere metal ion source, 15:3301 (R;US)
Charge state distribution studies of the metal vapor vacuum arc ion source, 15:3302 (R;US)
Comparison of H^{minus} and D^{minus} production in a magnetically filtered multicusp source, 15:4439 (R;US)
Development of a laser ion source for xenon, 15:3295 (RA;DE;In German)
ECR sources for the production of highly charged ions, 15:3306 (R;US)
Image-projection ion-beam lithography, 15:3906 (J;US)
Investigation of boundary for the negative ion extraction in the sheet-plasma negative ion source, 15:4349 (R;JP)
Operation of a DC large aperture volume-production H^- source, 15:3305 (R;US)
Operational characteristics of a metal vapor vacuum arc ion source, 15:3891 (R;US)
Some novel design features of the LBL metal vapor vacuum arc ion sources, 15:3303 (R;US)
The source for polarized alkali ions, 15:3290 (RA;DE;In German)

ION-ION COLLISIONS
Symmetric charge transfer to multiply charged ions, 15:3914 (J;US)

ION-MOLECULE COLLISIONS
Impact-parameter treatment of high-velocity electron capture from diatomic molecules at fixed orientation, 15:3920 (J;US)
Interactions of fast atomic and molecular ions with matter, 15:4210 (R;US)

IONIC REACTIONS
See CHEMICAL REACTIONS

IONIZATION
See also AUTOIONIZATION
Estimation method of reionization loss in the drift ducts for JT-60 NBI, 15:4422 (R;JP;In Japanese)

IONIZATION CALORIMETERS
See SHOWER COUNTERS

IONIZATION CHAMBERS
Angular dependence of parallels plates ionization chambers for x radiation, 15:3337 (R;BR;In Portuguese)
Conection factors for clinical dosemeters used in dosimetry of large fields radiation, 15:3336 (R;BR;In Portuguese)

IONIZING RADIATIONS
See also COSMIC RADIATION
GAMMA RADIATION
X RADIATION
Radiation physics, biophysics, and radiation biology: Progress report, December 1, 1988–November 30, 1989, 15:3694 (R;US)

IONOPHORESIS
See ELECTROPHORESIS

IONOSPHERE
Auroral energy deposition over the polar ionosphere during substorms. Technical report, 15:3882 (R;US)
Fields and flows in diffusing ionospheric plasmas, 15:4362 (BA;US)
Optical instrumentation support for the airborne ionospheric observatory. Report for 1 July 1987-30 June 1988, 15:3884 (R;US)

IONS (ATOMIC)
See ATOMIC IONS

IONS (MOLECULAR)
See MOLECULAR IONS

IOWA
Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly, 15:3580 (R;US)
Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly. Appendix 2. Written comments, 15:3581 (R;US)

IRON
Effects of iron particles on behavior and brain function: Initial studies, 15:3756 (R;US)
Surface magneto-optical studies of ultrathin ferromagnetic films, 15:2822 (R;US)
The effects of annealing on the structure and distribution of charge states of iron implanted into α-Al_2O_3 at 77 K, 15:2907 (R;US)
The reactions of iron clusters with water, 15:3091 (J;US)

IRON 52
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

IRON 54
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

IRON 56 REACTIONS
Correlations between fragment mass and excitation energy in damped reactions, 15:4168 (J;US)

IRON ALLOYS
See also ALLOY-NI59CR30FE9
ALLOY-NI76CR15FE8
HAYNES 188 ALLOY
IRON BASE ALLOYS
Effect of chromium on properties of Fe_3Al, 15:2874 (J;US)
Influence of microstructure and microdamage processes on fracture at high loading rates. Final report, 1 February 1986-30 September 1988, 15:2806 (R;US)
Kinetic paths of B2 and DO_3 order parameters: Experiment, 15:2872 (J;US)

IRON BASE ALLOYS
See also ALLOY-FE46NI33CR21
STEELS
Acoustic emission during integranular stress corrosion cracking, 15:2849 (R;US)
Spin dynamics of amorphous $Fe_{90-x}Ni_xZr_{10}$, 15:2819 (R;US)

IRON IONS
Direct and resonance contributions to electron-impact excitation of n=2 to n=3 transitions in neonlike ions, 15:3907 (J;US)
Measurement of relative electron-impact-excitation cross sections for Fe^{24+}, 15:3925 (J;US)

IRON ORES
Scoria analysis by X-ray fluorescence with briquet, 15:4224 (R;BR;In Portuguese)

IRON OXIDES
Role of $Fe_xCr_{2-x}O_3$ standard solid solutions in the identification of rhombohedral phase composition by XRD, 15:2815 (R;GB)
Synthesis of oxide powders by plasma vaporization of solutions, 15:2938 (BA;US)

IRON SULFATES
Enhanced coal liquefaction by low-severity catalytic reactions: Final report, 15:2026 (R;US)

IRON-AIR BATTERIES
Analysis of life cycle costs for electric vans with advanced battery systems, 15:2583 (B;US)

IRON-NICKEL BATTERIES
Analysis of life cycle costs for electric vans with advanced battery systems, 15:2583 (B;US)

IRRADIATION DEVICES
Peculiarities of testing and introduction into clinical practice of Selectron installation in Research Institute of Health Ministry of Byelorussian SSR, 15:3669 (RA;SU;In Russian)

IRRADIATION RIGS
See IRRADIATION DEVICES

IRRIGATION
Optimal real-time pump and irrigation scheduling for center-pivot sprinkler systems, 15:2724 (R;US)

ISOELECTRONIC ATOMS
QED based on self-energy: The relativistic $2S_{1/2}$ -> $1S_{1/2}+1\gamma$ decay rates of hydrogenlike atoms, 15:3888 (R;XA)

ISOTOPE DATING
Optically stimulated luminescence, 15:3061 (RA;DE;In German)
Thermoluminescence dating of archaeometallurgical slags and ceramics, 15:3059 (RA;DE;In German)
Thermoluminescence dating of sediments, 15:3060 (RA;DE;In German)

ISOTOPE ENRICHMENT
See ISOTOPE SEPARATION

ISOTOPE SEPARATION
See also GASEOUS DIFFUSION PROCESS
Membrane gas separation. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3065 (R;US)

ISOTOPE SHIFT
See SPECTRAL SHIFT

ISOTOPES
See also CADMIUM ISOTOPES
DAUGHTER PRODUCTS
FISSION PRODUCTS
RADIOISOTOPES
TIN ISOTOPES
Activation cross section data file, 15:4157 (R;JP;In Japanese)
Stable isotope studies: Progress report, October 1988–October 1989, 15:3075 (R;US)

ISOTOPIC SEPARATION
See ISOTOPE SEPARATION

ISOTOPIC SHIFT
See SPECTRAL SHIFT

ITALY
Contribution to atmospheric pollution of the activities of CSI Italsider in Bagnoli, 15:3415 (TG;US)

ITER TOKAMAK
A high-speed beam of lithium droplets for collecting diverted energy and particles in ITER [International Thermonuclear Experimental Reactor], 15:4430 (R;US)
ITER [International Thermonuclear Experimental Reactor] in perspective, 15:4452 (R;US)
ITER disruption modeling using TSC [Tokamak Simulation Code], 15:4301 (R;US)
The International Thermonuclear Experimental Reactor configuration evolution, 15:4387 (R;US)
The status of work on the ITER project in the USSR, 15:4402 (TG;US)

IUS
See TOTAL ENERGY SYSTEMS

J

JAILS
See PUBLIC BUILDINGS

JAMES A. FITZPATRICK REACTOR
See FITZPATRICK REACTOR

JAPAN
On economics of hot dry rock geothermal power station, 15:2353 (TG;US)

JAPAN MATERIALS TESTING REACTOR
See JMTR REACTOR

JET ENGINE FUELS
Compatibility of fuel-system components with high density fuel. Final report, April 1987-January 1989, 15:2781 (R;US)
Properties of F-34 (JP-8) fuel for 1988. Summary report, January-December 1988, 15:2119 (R;US)
Wide-range fuel flowmeter. Phase 2. Final report, 4 June 1986-3 February 1988, 15:2121 (R;US)

JET MODEL
Average transverse momentum in the geometrical branching model with jets, 15:3979 (R;US)
Jet production and decay in relativistic pp collisions, 15:3995 (RA;DE)
Recent results from the CDF [Collider Detector at Fermilab] experiment at the Tevatron proton-antiproton collider, 15:3953 (R;US)

JET REACTORS
See JET TOKAMAK

JET TOKAMAK
Model for calculating room air and surface tritium concentrations, 15:3480 (R;GB)

JFT-2M TOKAMAK
High density current drive experiments on JFT-2M, 15:4321 (RA;JP)

JMTR REACTOR
Fabrication of uranium-plutonium mixed carbide fuel pins for JMTR irradiation capsules, 84F-10A, 84F-12A and 87F-2A, 15:2461 (R;JP;In Japanese)

JOSEPHSON EFFECT
Inverse a-c Josephson effect at terahertz frequencies, 15:3119 (R;US)

JOSEPHSON JUNCTIONS
Inverse a-c Josephson effect at terahertz frequencies, 15:3119 (R;US)

JOURNAL BEARINGS
Hydrodynamic journal bearings: Capacity, wear, and lubrication. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989, 15:3134 (R;US)

JT-60 REACTORS
See JT-60 TOKAMAK
JT-60 TOKAMAK
ERATO-code analysis of vacuum magnetic field oscillations in JT-60 divertor configuration, 15:4425 (R;JP;In Japanese)
Estimation method of reionization loss in the drift ducts for JT-60 NBI, 15:4422 (R;JP;In Japanese)
Plasma conductivity related to bootstrap current on JT-60, 15:4333 (RA;JP)
Upgrade of JT-60 pellet injector for higher velocity, 15:4423 (R;JP;In Japanese)
JUPITER PLANET
Cold nuclear fusion in metallic hydrogen and normal metals, 15:4169 (J;US)
Time-variable phenomena in the Jovian system, 15:3867 (R;US)

K

K01
See KAONS NEUTRAL SHORT-LIVED
K02
See KAONS NEUTRAL LONG-LIVED
KALPAKKAM-1 REACTOR
Environmental radiation levels in and around Kalpakkam during 1983-1987, 15:4183 (R;IN)
KALPAKKAM-2 REACTOR
Environmental radiation levels in and around Kalpakkam during 1983-1987, 15:4183 (R;IN)
KAON MINUS-PROTON INTERACTIONS
Radiative kaon capture at rest in hydrogen, 15:3971 (J;US)
KAONIC ATOMS
Light kaonic and antiprotonic atoms, 15:3893 (R;GB)
KAONS
See also KAONS NEUTRAL
Experimental investigations in particle physics at intermediate energies: Performance report, December 1, 1988–December 31, 1989, 15:3951 (R;US)
QCD corrections to weak decays, 15:3982 (R;US)
Rare decays, 15:3965 (R;US)
Weak decays of *K* and π mesons, 15:4013 (J;US)
KAONS 1
See KAONS NEUTRAL SHORT-LIVED
KAONS 2
See KAONS NEUTRAL LONG-LIVED
KAONS NEUTRAL
See also ANTIKAONS NEUTRAL
KAONS NEUTRAL LONG-LIVED
KAONS NEUTRAL SHORT-LIVED
$K_L^0 \rightarrow \mu^{\mp}e^{\pm}$ at the Fermilab main injector, 15:3950 (R;US)
Status of BNL E791: Study of very rare K_L^0 decays, 15:3984 (R;US)
KAONS NEUTRAL LONG-LIVED
Possible test of *CPT* invariance in neutral-kaon regeneration, 15:4028 (J;US)
KAONS NEUTRAL SHORT-LIVED
Possible test of *CPT* invariance in neutral-kaon regeneration, 15:4028 (J;US)
KELLOGG RUST WESTINGHOUSE PROCESS
See KRW GASIFICATION PROCESS
KETENES
Photofragmentation of ketene to $CH_2(\tilde{X}^3B_1)$ + CO: Dissociation rate, energy release and exit barrier height, 15:3096 (R;US)
KIDNEYS
The behavior and chemical toxicity of U in the kidney: A reassessment, 15:3753 (J;US)
KNOCK-ON ELECTRONS
See ELECTRONS
KNOWLEDGE BASE
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
KOREA (SOUTH)
See REPUBLIC OF KOREA
KRW GASIFICATION PROCESS
Advanced gasifier-desulfurizer process development for SNG (substitute natural gas) application. Final report, August 1987-December 1988, 15:2047 (R;US)
KRYPTON
Anharmonic damping in rare-gas multilayers, 15:2888 (J;US)
Temperature dependence of Kr precipitation in Ni, 15:2864 (BA;US)
KRYPTON FLUORIDE LASERS
Design and performance of future KrF laser-fusion facilities, 15:4437 (R;US)
Kilojoule operation of the Aurora KrF ICF laser system at Los Alamos, 15:4453 (BA;US)

L

L CODES
Crack propagation analysis of WECS components using the LIFE2 computer code, 15:2398 (BA;US)
LA REINA REACTOR
See RESEARCH REACTORS
LABORATORIES
Activities of the neutron activation analysis laboratory of the radiochemistry division of IPEN - CNEN/SP, 15:4494 (R;BR;In Portuguese)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Analytical laboratories, 15:2740 (R;US)
The architectural ergonomics of Sandia's RHIC-II growing facility, 15:3229 (BA;US)
The radiation-hardened integrated circuit (RHIC) laboratory: Pursuit of Class 1, 15:3228 (BA;US)
Waste audit study: Research and educational institutions, 15:2746 (R;US)
LABORATORY ANIMALS
Heavy metals in drinking water: Standards, sources, and effects. January 1978-September 1989 (Citations from the Life Sciences Collection data base). Report for January 1978-September 1989, 15:3564 (R;US)
LABORATORY EQUIPMENT
See also MANIPULATORS
State control in the GDR of the handling of unsealed radioactive materials in laboratories of type I to III, 15:4196 (R;DD;In German)
LABORATORY SCALE EXPERIMENTS
See BENCH-SCALE EXPERIMENTS
LAGRANGE FIELD EQUATIONS
See LAGRANGIAN FIELD THEORY
LAGRANGIAN FIELD THEORY
The spectrum of topological quantum field theories on N-manifolds, 15:4050 (J;NL)
LAKES
Characterization of year-round sensitivity of California's Montane Lakes to acidic deposition. Final report, October 1986-June 1989, 15:3552 (R;US)
Ecological aspects of lake regulation in Northern Finland. Part 2. Geomorphology and vegetation of the littoral zone, 15:2287 (R;FI;In Finnish)
Ecological aspects of lake regulation in Northern Finland. Part 5. Regulation practices and ecological effects, 15:2290 (R;FI;In Finnish)
Ecological aspects of lake regulation in northern Finland. Part 3. Macrozoobenthos and feeding of fish, 15:2288 (R;FI;In Finnish)
Ecological aspects of lake regulation in northern Finland. Part 4. Spawning and the survival of the young fish, 15:2289 (R;FI;In Finnish)
LAMBDA NEUTRAL
See LAMBDA PARTICLES
LAMBDA PARTICLES
Radiative kaon capture at rest in hydrogen, 15:3971 (J;US)

LAMPF LINAC
Progress at LAMPF: Progress report, January–December 1988, 15:3946 (R;US)
Report from the workshop on computing directions and options for data acquisition and analysis at LAMPF [Los Alamos Meson Physics Facility], 15:3297 (R;US)

LAND APPLICATION
See GROUND DISPOSAL

LAND FILLS
See SANITARY LANDFILLS

LAND POLLUTION
Bench-scale fixation of soils from the Tacoma Tar Pits Superfund Site. Final report, 15:3521 (R;US)
Response to comments: Background document for the second third-land disposal restrictions proposed rule: Policy-related comments, 15:3518 (R;US)
Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report, 15:3527 (R;US)
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988, 15:3526 (R;US)
Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action, 15:3591 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989, 15:3534 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)
Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report, 15:3523 (R;US)
Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report, 15:3528 (R;US)
Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report, 15:3532 (R;US)
Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988, 15:3524 (R;US)
Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988, 15:3500 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)

LAND RECLAMATION
Proceedings of the conference: reclamation, a global perspective, 15:2079 (R;CA)
Selection with minimal bias, of an experimental control from natural wetland environments. Technical report (Final), 15:3576 (R;US)
Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988, 15:3529 (R;US)

LANDFILLS
See SANITARY LANDFILLS

LANGMUIR OSCILLATIONS
See PLASMA WAVES

LANL
Design and operation of high efficiency electron-beam-initiated chemical lasers, 15:3171 (BA;US)
Kilojoule operation of the Aurora KrF ICF laser system at Los Alamos, 15:4453 (BA;US)
Status of the design and construction of the CPRF and the ZTH reversed field pinch experiment, 15:4360 (BA;US)

LANTHANIDES
See RARE EARTHS

LANTHANUM 139 TARGET
Binary complex fragment emission and multifragmentation from very hot nuclei, 15:4099 (R;US)
Excitation energy equilibration in damped $^{139}La+^{40}Ar$ collisions at 15 MeV per nucleon, 15:4100 (J;US)

LANTHANUM CHROMITES
See CHROMIUM OXIDES
LANTHANUM OXIDES

LANTHANUM COMPOUNDS
See also LANTHANUM HYDRIDES
LANTHANUM OXIDES
LANTHANUM SULFIDES
Electron-positron momentum distribution measurements of high-T superconductors and related systems, 15:4258 (R;US)
Linear electron-hole-electron pair model of high-temperature superconductivity in $La_{2-x}M_xCuO_4$ and $YBa_2Cu_3O_{7-y}$: 2, Dependence of the superconducting transition temperatures on pressure and on hole concentration, 15:4251 (R;US)

LANTHANUM HYDRIDES
Heat capacities of LaD_x and LaH_x ($1.9 \leq x \leq 3.0$) from 1 to 300 K, 15:2955 (J;US)

LANTHANUM IONS
Electron-impact ionization of La^{q+} ions (q=1,2,3), 15:3917 (J;US)

LANTHANUM OXIDES
Lattice mode study of La_2CuO_{4-y} implanted with Sr, 15:2937 (BA;US)
Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)
[Dynamics of magnetic fluctuations in high-T_c materials]: Foreign trip report, October 5–October 15, 1989, 15:4257 (R;US)

LANTHANUM SULFIDES
Thermophysical properties of the lanthanide sesquisulfides. I. Schottky functions and magnetic and electronic properties of γ-La_2S_3, γ-Ce_2S_3, γ-Nd_2S_3, and γ-Gd_2S_3, 15:3021 (J;US)

LARYNX
Influence of local UHF-hyperthermia on frequency of postradiation larynx chondroperichondrites, 15:3659 (RA;SU;In Russian)

LASER FUSION REACTORS
Effects of laser beam smoothing on laser-plasma interaction, 15:4454 (BA;US)
NTES [Nuclear Test and Experimental Sciences Program] laser facility for physics experiments Building 391 High Bay Option, 15:4442 (R;US)

LASER IMPLOSIONS
Implosion symmetry and stability, 15:4386 (R;FR)

LASER MATERIALS
Excited state absorption of Sm^{2+} in SrF_2, 15:3178 (J;US)
Laser glass (1989), 15:3168 (R;US)

LASER RADIATION
Behavioral measurement of laser flashblindness in rhesus monkeys. Final report, June-August 1985, 15:3796 (R;US)
Dynamics of coupled electron-nucleon motion in a laser field, 15:3173 (J;US)
Eye/sensor protection against laser irradiation: Organic nonlinear optical materials. Final report, April-December 1988, 15:3798 (R;US)
Improved laser-beam uniformity using the angular dispersion of frequency-modulated light, 15:3184 (J;US)
Propagation of a laser beam through self-induced turbulence, 15:3886 (J;US)
Treatment of laser-induced retinal injuries. Final report, 12 February 1985-31 January 1987, 15:3797 (R;IL)

LASER TARGETS
Cryogenic-laser-fusion target implosion studies performed with the OMEGA uv-laser system, 15:4484 (J;US)

LASER WELDING
Heat transfer, 15:2805 (B;US)

LASER-PRODUCED PLASMA
Computer simulation of laser plasma interaction: Progress report for 1988, 15:4354 (R;US)
Generation of axial and lateral magnetic fields in laser produced plasmas, 15:4315 (R;XA)
The coupling of stimulated Raman and Brillouin scattering in a plasma, 15:4353 (R;US)
The theory of target compression by longwave laser emission, 15:4359 (B;US)

LASERS
See also CHEMICAL LASERS
FREE ELECTRON LASERS
GAS LASERS
LIQUID LASERS
SOLID STATE LASERS
X-RAY LASERS
Broadband phase conversion of the frequency tripled Omega laser, 15:4370 (BA;US)
Laser physics and laser techniques. Final report, 15:3154 (R;US)
Lasers without inversion: Interference of lifetime-broadened resonances, 15:3152 (R;US)
Non-reciprocity of autoionizing interferences: Lasers without inversion, 15:3151 (R;US)
Polarization spectroscopy in analytical measurements, 15:3067 (J;US)
Thermal stress in the edge cladding of Nova glass laser disks, 15:3172 (BA;US)

LATENT HEAT STORAGE
Thermal energy storage. July 1987-September 1989 (Citations from the NTIS data base). Report for July 1987-September 1989, 15:2566 (R;US)

LATTICE DEFECTS
See CRYSTAL DEFECTS

LATTICE FIELD THEORY
Block-conjugate-gradient method, 15:4058 (J;US)
Research in theoretical physics: Technical progress report, 15:4033 (R;US)

LATTICES (CRYSTAL)
See CRYSTAL LATTICES

LAUNDRIES
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Dry cleaners and commercial laundries, 15:2739 (R;US)

LAWRENCE BERKELEY LABORATORY
Earth Sciences Division annual report 1988, 15:3811 (R;US)
High school honors program, July 23–August 5, 1989: Revision, October 1989, 15:2609 (R;US)

LAWRENCE LIVERMORE LABORATORY
Energy and Technology Review, October 1989, 15:4355 (R;US)

LEAD
Anomalous local hopping of Sn impurities in lead, 15:2881 (J;US)
Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)
Electrophysiological systems for neurotoxicity field testing: PEARL II and alternatives, 15:3780 (R;US)
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)
Search for the quark-gluon plasma (1989): The NA35 experiment at the CERN SPS, 15:4066 (R;US)
Translation of reports from the first international conference on neutron physics, Kiev, USSR, 14-18 September 1987, 15:4179 (R;XA)
Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987, 15:4416 (R;XA)

LEAD 206 TARGET
Quasielastic scattering of polarized ^{23}Na, 15:4097 (RA;DE;In German)

LEAD 207 TARGET
Delayed-fission properties of neutron-deficient americium nuclei, 15:4120 (R;US)

LEAD 208 TARGET
Coulomb breakup of ^{7}Li, 15:4109 (RA;DE;In German)

LEAD 210
Atmospheric depositional characteristics of Beryllium 7 and Lead 210 along Southeastern Virginia coast, 15:3490 (J;US)

LEAD ALLOYS
Structural properties of liquid alkali-metal–lead alloys: NaPb, KPb, RbPb, and CsPb, 15:2887 (J;US)

LEAD METHOD
See ISOTOPE DATING

LEAD ORES
Geological interpretation of lead isotope ratios in ores from the Aegaean, 15:3493 (RA;DE;In German)

LEAD OXIDES
Electronic structure of $Pb_2Sr_2PrCu_3O_8$ as studied by resonant photoemission spectroscopy, 15:2956 (J;US)
Variation of T_{c0} in the 110 K superconductor $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$, 15:2949 (J;US)

LEAD-ACID BATTERIES
Analysis of life cycle costs for electric vans with advanced battery systems, 15:2583 (B;US)
Development of advanced battery systems for vehicle applications, 15:2587 (B;US)
Status and results of ANL life evaluation of valve-regulated lead-acid load-leveling batteries, 15:2574 (R;US)

LEARNING
Parallel processing and learning in simple systems. Final report, 10 January 1986-14 January 1989, 15:3595 (R;US)

LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

LEPTON-NUCLEON INTERACTIONS
See also ELECTRON-NUCLEON INTERACTIONS
Testing string dynamics in lepton nucleus reactions, 15:4067 (R;US)

LEVITATED TRAINS
Opportunities and prospects for Maglev in North America, 15:2709 (R;US)

LIE GROUPS
See also GRADED LIE GROUPS
Further study of global gauge anomalies of simple groups, 15:4027 (J;US)
Left-right symmetric electroweak models, 15:4017 (R;US)

LIE SUPERALGEBRA
See GRADED LIE GROUPS

LIGHT NUCLEI
See also BERYLLIUM 7
BORON 10
CARBON 11
DEUTERIUM
FLUORINE 18
LITHIUM 7
MAGNESIUM 26
OXYGEN 17
SILICON 27
SODIUM 23
SODIUM 24
SULFUR 35
TRITIUM
Systematics of neutron single particle energies for $16 \leq A \leq 50$, 15:4135 (RA;DE;In German)

LIGHTNING ARRESTERS
Lightning, surge, and transient protection. December 1982-September 1989 (Citations from the NTIS data base). Report for December 1982-September 1989, 15:2433 (R;US)

LIGNIN
Cellulose and lignin: Biodegradation. June 1987-September 1989 (Citations from the Life Sciences Collection data base). Report for June 1987-September 1989, 15:2300 (R;US)

LIGNITE
Relationships between natural weathering and lignite biosolubility or alkali solubility, 15:2063 (R;US)
LIMESTONE
ANEOS [analytic equation of state package] models for shock compression of saturated limestone: Applications to ground shock calculations, 15:3081 (R;US)
LIMING
Effects of acid and lime on mesofauna of forest soils in the laboratory and in the field. Final report, 15:3762 (R;DE;In German)
LINACS
See LINEAR ACCELERATORS
LINEAR ACCELERATORS
See also LAMPF LINAC
LINEAR COLLIDERS
STANFORD LINEAR COLLIDER
Applications of RF linacs to free-electron lasers and particle beams, 15:3312 (J;US)
Applications of induction linacs to free-electron lasers and particle beams, 15:3313 (J;US)
Classification of beam breakup instabilities in linear accelerators, 15:3282 (J;US)
Induction linear accelerators for commercial photon irradiation processing, 15:3267 (R;US)
Proton linac for hospital-based fast neutron therapy and radioisotope production, 15:3619 (R;US)
RLA simulations, 15:3274 (R;US)
LINEAR COLLIDERS
An adiabatic focuser, 15:3277 (R;US)
LINEAR MOMENTUM
Performance methods (again—), 15:2368 (RA;DK)
LINEAR Z PINCH DEVICES
Fusion burn dynamics in dense Z-pinches (DZP), 15:4342 (R;US)
LINERS
Elevated temperature crack growth, 15:3246 (RA;US)
Hydrogen permeability coefficient determinations for used waste drum liners, 15:2985 (R;US)
Structural response of an advanced combustor liner: Test and analysis, 15:3245 (RA;US)
Three-dimensional inelastic analysis methods for hot section components, 15:3237 (RA;US)
LIQUEFIED NATURAL GAS
Dike insulation for LNG (liquefied natural gas) vapor mitigation. Topical report, September 1987-December 1988, 15:2154 (R;US)
Hazardous-materials transportation. September 1982-September 1989 (Citations from the COMPENDEX data base). Report for September 1982-September 1989, 15:2715 (R;US)
LIQUEFIERS
See CONDENSERS
LIQUID CRYSTALS
Conformation, orientation and interaction in molecular monolayers: A surface second harmonic and sum frequency generation study, 15:4234 (R;US)
LIQUID EFFLUENTS
See LIQUID WASTES
LIQUID FLOW
Stability of core-annular flow in a rotating pipe, 15:3941 (J;US)
LIQUID FUELS
High-energy-density solid and liquid hydrocarbon fuels. Final report, July 1987-December 1988, 15:2120 (R;US)
LIQUID LASERS
See also DYE LASERS
Liquid excimers: lasing Xe_2 and Kr_2 in liquid argon, 15:3179 (J;US)
LIQUID METAL TEST FACILITIES
See TEST FACILITIES
LIQUID WASTES
See also WASTE WATER
Development of a centralized solvent recovery system at Carswell Air Force Base, 15:3801 (R;US)
Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska, 15:2717 (R;US)
Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska, 15:2716 (R;US)
Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska, 15:2721 (R;US)
Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska, 15:2723 (R;US)
Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska, 15:2722 (R;US)
Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska, 15:2720 (R;US)
Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska, 15:2719 (R;US)
Slurry-fed ceramic melter–A broadly accepted system to vitrify high-level waste, 15:2226 (R;US)
LIQUID-PHASE SINTERING
See SINTERING
LIQUIDS
See also COAL LIQUIDS
LIQUID CRYSTALS
Cavitation-controlled ultrasonic agitator, 15:3366 (R;US)
Effect of density change on rapid liquid-solid interface kinetics and heat flow, 15:3208 (BA;US)
Mixing times during the stirring of gas-charged viscous liquids (Part 3), 15:2756 (TJ;US)
Molecular dynamics for discontinuous potential. IV. Lennard-Jonesium, 15:3089 (J;US)
Statistical mechanical models for liquid and amorphous structure in covalently bonded systems, 15:4217 (R;XA)
X-ray diffraction study of liquid *n*-butane at 140 and 267 K, 15:3088 (J;US)
[Gamma scattering in condensed matter with high intensity Moessbauer radiation]: Progress report, 15:4212 (R;US)
LITHIUM
Heat transfer in condensation of lithium vapors, 15:4404 (R;US)
Rechargeable lithium/polymer cathode batteries. Technical report, July 1988-June 1989, 15:2570 (R;US)
Use of lithium batteries in biomedical devices. Technical report No. 8, July 1988-June 1989, 15:2569 (R;US)
LITHIUM 6 TARGET
Polarized proton scattering on lithium isotopes at 14 MeV, 15:4427 (R;JP)
LITHIUM 7
Coulomb breakup of ^{7}Li, 15:4109 (RA;DE;In German)
LITHIUM 7 BEAMS
Laser cooling, 15:3294 (RA;DE;In German)
LITHIUM 7 REACTIONS
Coulomb breakup of ^{7}Li, 15:4109 (RA;DE;In German)
Single neutron transfer reactions induced by polarized ^{7}Li ions, 15:4136 (RA;DE)
LITHIUM 7 TARGET
Polarized proton scattering on lithium isotopes at 14 MeV, 15:4427 (R;JP)
LITHIUM COMPOUNDS
See also LITHIUM OXIDES
Fluorescence and optical absorption in spodumene, 15:2971 (R;BR;In Portuguese)
LITHIUM FLUORIDES
Light sensitivity of .13 mm thick LiF-teflon thermoluminesence dosimeters, 15:4185 (R;US)
LITHIUM IONS
Lithium beam measurements on PBFA II, 15:3311 (BA;US)
Relativistic distorted wave collision strengths and oscillator strengths for the 85 Li-like ions with $8 \leq Z \leq 92$, 15:3897 (R;US)
LITHIUM OXIDES
Method of fabricating optical waveguides by ion implantation doping, 15:2964 (P;US)
Optical waveguide formation by ion implantation of Ti or Ag, 15:2940 (BA;US)
LITHIUM-CHLORINE BATTERIES
Battery actuation of NITINOL at sub-zero temperatures, 15:2572 (R;US)
Lithium batteries. October 1987-September 1989 (Citations from the COMPENDEX data base). Report for October 1987-September 1989, 15:2580 (R;US)

LITHIUM-SULFUR BATTERIES
Lithium batteries. October 1987-September 1989 (Citations from the COMPENDEX data base). Report for October 1987-September 1989, 15:2580 (R;US)
LIVER CELLS
Comparison of the production and phenotypic properties of altered hepatocyte foci in rats initiated with diethylnitrosamine neonatally or after partial hepatectomy in early adulthood, 15:3599 (R;US)
LMFBR TYPE REACTORS
See also EBR-2 REACTOR
Fuel/sodium reaction product formation in breached mixed-oxide fuel, 15:2463 (J;US)
Safety aspects of the US advanced LMR [liquid metal reactor] design, 15:2501 (R;US)
Summary of advanced LMR [Liquid Metal Reactor] evaluations: PRISM [Power Reactor Inherently Safe Module] and SAFR [Sodium Advanced Fast Reactor], 15:2546 (R;US)
LNG
See LIQUEFIED NATURAL GAS
LOAD MANAGEMENT
Industrial load management at Vaargaarda, 15:2641 (R;SE;In Swedish)
LOADS (STATIC)
See STATIC LOADS
LOCA
See LOSS OF COOLANT
LOCAL GOVERNMENT
Local government techniques for inland wetlands protection. Technical report, 15:3585 (R;US)
LOCOMOTIVES
Fuel-injected system for diesel engines with injection pressure control, 15:2787 (R;JP)
LOFT REACTOR
DOE modifications to the MAAP [Modular Accident Analysis Program] code: Volume 6, Core melt progression modeling and benchmarking WBS 3.4.8, 15:2515 (R;US)
Modeling of thermal hydraulic behavior and fission product releases in degraded cores, 15:2517 (R;US)
LONG WAVE RADIATION
ELF (extremely low frequency) communications system ecological monitoring program: Electromagnetic field measurements and engineering support – 1988. Technical report, 1982-1988, 15:3795 (R;US)
LONG-LENS SPECTROMETERS
See MAGNETIC LENS SPECTROMETERS
LONG-RANGE TRANSPORT
Calculation of air pollution dispersion over a complex terrain with special emphasis on dimensioning of chimney stacks, 15:3420 (R;DK;In Danish)
LONGITUDINAL PINCH DEVICES (LINEAR)
See LINEAR Z PINCH DEVICES
LOOPS (COOLANT)
See COOLANT LOOPS
LOS ALAMOS MESON PHYSICS FACILITY
See LAMPF LINAC
LOS ALAMOS NATIONAL LABORATORY
See LANL
LOS ANGELES
Turning off the tap: Strategies for hazardous waste minimization in the city of Los Angeles, 15:2776 (R;US)
LOSS CONE
Effect of loss cone on confinement in toroidal helical device, 15:4348 (R;JP)
LOSS OF COOLANT
Critical investigations and model development on countercurrent flow of gas and liquid in horizontal and vertical channels. Final report, 15:2530 (R;DE;In German)
Event tree for the Angra 1 big LOCA, 15:2447 (R;BR;In Portuguese)
Maanshan T_pS_LB accident analysis, 15:2559 (J;US)
LOSS OF FLUID TEST REACTOR
See LOFT REACTOR
LOVIISA-1 REACTOR
Operation of Finnish nuclear power plants. Quarterly report, 2. quarter 1988, 15:2451 (R;FI)
Operation of Finnish nuclear power plants. Quarterly report, 3. quarter 1988, 15:2452 (R;FI)
LOVIISA-2 REACTOR
Operation of Finnish nuclear power plants. Quarterly report, 2. quarter 1988, 15:2451 (R;FI)
Operation of Finnish nuclear power plants. Quarterly report, 3. quarter 1988, 15:2452 (R;FI)
LOW FREQUENCY RADIATION
See LONG WAVE RADIATION
LOW-BETA PLASMA
Structure of slow magnetosonic shocks in low beta plasmas, 15:4371 (J;US)
LOW-LEVEL RADIOACTIVE WASTES
1988 annual report on low-level radioactive waste management progress, 15:2187 (R;US)
Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report, 15:2195 (R;US)
Impact of technology applications to the management of low-level radioactive wastes, 15:2182 (R;US)
Recommendations for evaluating environmental monitoring programs for alternative low-level waste facilities, 15:2231 (R;US)
Site characterization program at the radioactive waste management complex of the Idaho National Engineering Laboratory: Annual progress report: FY-1988, 15:2186 (R;US)
Soil physical properties at the Las Cruces trench site, 15:2218 (R;US)
Standard Review Plan for a petition for rulemaking on radioactive waste streams below regulatory concern: Expedited review in accordance with Appendix B to 10 CFR, Part 2: Data report for comment, 15:2213 (R;US)
Training waste generators: The first responder in proper waste management, 15:2184 (R;US)
Workshop on cement stabilization of low-level radioactive waste: Proceedings, 15:2214 (R;US)
LOWER HYBRID HEATING
High efficiency LHCD experiments on JT-60, 15:4417 (RA;JP)
Lower hybrid current drive model and its comparison with experiments, 15:4326 (RA;JP)
LOWER HYBRID RESONANCE HEATING
See LOWER HYBRID HEATING
LUBRICANTS
See also GREASES
LUBRICATING OILS
SYNTHETIC LUBRICANTS
Lubricants and greases: Properties and evaluation. January 1973-April 1988 (Citations from Fluidex data base). Report for January 1973-April 1988, 15:3135 (R;US)
Lubricants and greases: Properties and evaluation. May 1988-September 1989 (Citations from Fluidex data base). Report for May 1988-September 1989, 15:3136 (R;US)
Lubrication for high and extreme pressures. January 1971-September 1989 (Citations from the US Patent data base). Report for January 1971-September 1989, 15:3219 (R;US)
Lubrication for high and extreme pressures. January 1974-September 1989 (Citations from Fluidex data base). Report for January 1974-September 1989, 15:3218 (R;US)
LUBRICATING OILS
Lubricated pipelining: Stability of core-annular flow, 15:2134 (R;US)
LUMBER INDUSTRY
See WOOD PRODUCTS INDUSTRY
LUNGS
Asbestos cement dust inhalation by hamsters, 15:3793 (J;US)
Positron emission tomography of the lung, 15:3681 (BA;US)
Radiation response in patients with pulmonary carcinoma during remote gamma therapy by means of dynamic multifractionating, 15:3642 (RA;SU;In Russian)
LUTETIUM 153
The study of exotic N $\simeq$ 82 nuclei using the Daresbury recoil mass separator, 15:4101 (R;US)

LUTETIUM 154
The study of exotic N ≃ 82 nuclei using the Daresbury recoil mass separator, 15:4101 (R;US)
LUTETIUM ISOTOPES
See also LUTETIUM 153
LUTETIUM 154
Very high resolution saturation spectroscopy of lutetium isotopes via cw single-frequency laser resonance ionization mass spectrometry, 15:3905 (J;US)
LYMPHOCYTES
The Radiological Research Accelerator Facility: Progress report, December 1, 1988–November 30, 1989, 15:3695 (R;US)
LYMPHOGRANULOMA MALIGNUM
See HODGKINS DISEASE
LYMPHOGRANULOMATOSIS
See HODGKINS DISEASE
LYMPHOID CELLS
See LYMPHOCYTES

M

M CODES
A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation, 15:2541 (R;US)
Analysis of life cycle costs for electric vans with advanced battery systems, 15:2583 (B;US)
MA 754
See NICKEL BASE ALLOYS
MA 956
See IRON BASE ALLOYS
MAGMA SYSTEMS
Magma energy extraction: Annual report for FY88, 15:2360 (R;US)
MAGNESIUM 24 REACTIONS
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)
MAGNESIUM 24 TARGET
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)
MAGNESIUM 26
Fragmentation of high-spin particle-hole states in ^{26}Mg, 15:4081 (R;US)
MAGNESIUM 26 TARGET
Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures, 15:4082 (J;NL)
Single neutron transfer reactions induced by polarized ^{7}Li ions, 15:4136 (RA;DE)
MAGNESIUM HYDROXIDES
The effects of heavy metals on the scaling ability of $CaCO_3$ and $Mg(OH)_2$, 15:3041 (R;US)
MAGNESIUM OXIDES
Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)
Structure and insulator material choices for the TITAN reversed-field-pinch reactor study, 15:4470 (BA;US)
Synthesis of oxide powders by plasma vaporization of solutions, 15:2938 (BA;US)
MAGNET COILS
Design of a high-gain flux-compression generator, 15:4445 (R;US)
Measurements of electromagnetic properties of LCT coils in IFSMTF, 15:4478 (BA;US)
MAGNETIC BREMSSTRAHLUNG
See SYNCHROTRON RADIATION
MAGNETIC COILS
See MAGNET COILS
MAGNETIC DIPOLES
An alternate end design for SSC dipoles, 15:3300 (R;US)
Structural performance of the first SSC [Superconducting Super Collider] Design B dipole magnet, 15:3287 (R;US)
MAGNETIC FIELD CONFIGURATIONS
DIII-D F-coil chopper selection, control and fault recognition system, 15:4413 (R;US)
MAGNETIC FIELDS
EMDEX [Electric and Magnetic Field Digital EXposure] system manuals: Volume 2: Technical reference manual, 15:2425 (R;US)
Thermodynamic principles of the process of the effect of electromagnetic fields on a polymer melt, 15:3799 (R;US)
[Dynamics of magnetic fluctuations in high-T_c materials]: Foreign trip report, October 5–October 15, 1989, 15:4257 (R;US)
MAGNETIC LENS SPECTROMETERS
Developments at the Q3D spectrograph, 15:3338 (RA;DE;In German)
MAGNETIC LEVITATED TRAINS
See LEVITATED TRAINS
MAGNETIC MIRROR TYPE REACTORS
Cusp-stabilized mirror-based neutron source, 15:4482 (J;US)
MAGNETIC STORAGE DEVICES
Effect of media properties on side erase bands, 15:4521 (R;US)
MAGNETIC STORMS
Solar diurnal variation in the amplitude of sudden commencements of magnetic storms at the geomagnetic equator, 15:3885 (R;US)
MAGNETOHYDRODYNAMIC CHANNELS
See MHD CHANNELS
MAGNETOHYDRODYNAMICS
Nonlinear waves in cosmic ray magnetohydrodynamics, 15:3825 (RA;DE;In German)
Numerical simulation of the compressible Orszag-Tang vortex. Interim report, June 1988-February 1989, 15:3935 (R;US)
MAGNETOSPHERE
See EARTH MAGNETOSPHERE
MAGNETOTAIL
Extension of lower hybrid drift instability into the neutral sheet of the earth's magnetotail, 15:4367 (BA;US)
MAGNETS
First test of the Siberian snake magnet arrangement to overcome depolarizing resonances in a circular accelerator, 15:3281 (J;US)
Quadrupole magnet for the APS [Advanced Photon Source] storage ring, 15:3317 (R;US)
MAHOGANY TREES
See TREES
MAINTENANCE FACILITIES
Waste audit study: Automotive paint shops, 15:2744 (R;US)
MAIZE
Simultaneous determination of some nutrient elements in five varieties of maize by instrumental neutrons activation analysis, 15:3048 (R;BR;In Portuguese)
MALIGNANCIES
See NEOPLASMS
MAN
See also WOMEN
A perspective on human exposure to PCDDs and PCDFs emitted form municipal waste combustors, 15:3758 (R;US)
PCBs in humans: What we know and what we don't know, 15:3759 (R;US)
MAN-MACHINE SYSTEMS
Model for measuring complex performance in an aviation environment, 15:3127 (R;US)
Northeast Artificial Intelligence Consortium annual report for 1987. Volume 5. Building an intelligent assistant: The acquisition, integration, and maintenance of complex distributed tasks. Interim report, December 1986-December 1987, 15:4498 (R;US)
Solution bias in complex systems modeling, 15:4514 (R;US)
MANGANESE
Partial and total cross sections and multiplet structure in the photoionization of atomic manganese, 15:3923 (J;US)

MANGANESE 54
Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report, 15:3506 (R;DE;In German)
MANGANESE ALLOYS
Patterson analysis of aperiodic crystals, 15:2894 (J;US)
MANIPULATORS
Results of the Manipulator Test Test Stand study: Comparison of manipulators and evaluation of equipment items, 15:2170 (R;US)
Variable loading roller, 15:4533 (P;US)
MANUFACTURED BUILDINGS
See PREFABRICATED BUILDINGS
MANUFACTURING FACILITIES
See INDUSTRIAL PLANTS
MANY-BODY PROBLEM
Cumulant methods and short time propagators, 15:4299 (J;US)
Dynamic simulation of mixed quantum-classical systems, 15:4208 (R;US)
Generalization of Nose's isothermal molecular dynamics: Non-Hamiltonian dynamics for the canonical ensemble, 15:4295 (J;US)
MARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
MARINE VEHICLE ACCIDENTS
See ACCIDENTS
MARKETING
A study of aggregation bias in estimating the market for home heating and cooling equipment, 15:2687 (R;US)
MARS PLANET
Age Estimation
Crystal fractionation in the SNC meteorites: Implications for sample selection, 15:3846 (RA;US)
Examination of Martian sedimentary rocks to understand possible paleo-ocean and its age, 15:3844 (RA;US)
Overview of Mars: SNC meteorite results, 15:3847 (RA;US)
U-Th-Pb, Sm-Nd, Rb-Sr, and Lu-Hf systematics of returned Mars samples, 15:3845 (RA;US)
Valles Marineris, Mars: an optimum science-sample site, 15:3834 (RA;US)
Carbon Dioxide
Climate, atmosphere, and volatile inventory evolution: polar processes, climate records, volatile inventories, 15:3837 (RA;US)
Chemical Composition
Overview of Mars: SNC meteorite results, 15:3847 (RA;US)
Valles Marineris, Mars: an optimum science-sample site, 15:3834 (RA;US)
Climates
Climate, atmosphere, and volatile inventory evolution: polar processes, climate records, volatile inventories, 15:3837 (RA;US)
Martian weathering products as tracers of climate change and atmosphere/hydrosphere evolution on Mars, 15:3833 (RA;US)
Zeolites on Mars: Possible environmental indicators in soils and sediments, 15:3835 (RA;US)
Craters
Role of impact cratering for Mars sample return, 15:3841 (RA;US)
Crystal Structure
Crystal fractionation in the SNC meteorites: Implications for sample selection, 15:3846 (RA;US)
Degassing
Degassing history of Mars from Martian atmosphere samples, 15:3838 (RA;US)
Gamma Spectrometers
In situ XRF and gamma ray spectrometer for Mars sample return mission, 15:3355 (RA;US)
Geologic History
Cosmogenic nuclides in the Martian surface: constraints for sample recovery and transport, 15:3832 (RA;US)
Noble gases as tracers of the origin and evolution of the Martian atmosphere and the degassing history of the planet, 15:3843 (RA;US)
Role of impact cratering for Mars sample return, 15:3841 (RA;US)
Volcanic rocks and the geologic history of Mars, 15:3840 (RA;US)
Iron Oxides
What ferric oxide/oxyhydroxide phases are present on Mars, 15:3836 (RA;US)
Isotope Ratio
Accretion and primary differentiation of Mars, 15:3830 (RA;US)
Cosmogenic nuclides: Observable effects of Martian volatiles, 15:3839 (RA;US)
Degassing history of Mars from Martian atmosphere samples, 15:3838 (RA;US)
Overview of Mars: SNC meteorite results, 15:3847 (RA;US)
U-Th-Pb, Sm-Nd, Rb-Sr, and Lu-Hf systematics of returned Mars samples, 15:3845 (RA;US)
Isotopes
Cosmogenic nuclides in the Martian surface: constraints for sample recovery and transport, 15:3832 (RA;US)
Organic Compounds
Experimental simulations of oxidizing conditions and organic decomposition on the surface of Mars, 15:3842 (RA;US)
Photochemistry
Experimental simulations of oxidizing conditions and organic decomposition on the surface of Mars, 15:3842 (RA;US)
Physical Radiation Effects
Cosmogenic nuclides in the Martian surface: constraints for sample recovery and transport, 15:3832 (RA;US)
Planetary Atmospheres
Climate, atmosphere, and volatile inventory evolution: polar processes, climate records, volatile inventories, 15:3837 (RA;US)
Degassing history of Mars from Martian atmosphere samples, 15:3838 (RA;US)
Experimental simulations of oxidizing conditions and organic decomposition on the surface of Mars, 15:3842 (RA;US)
Martian weathering products as tracers of climate change and atmosphere/hydrosphere evolution on Mars, 15:3833 (RA;US)
Noble gases as tracers of the origin and evolution of the Martian atmosphere and the degassing history of the planet, 15:3843 (RA;US)
Planetary Evolution
Accretion and primary differentiation of Mars, 15:3830 (RA;US)
Stable isotopic studies of H,C,N,O and S in samples of Martian origin, 15:3848 (RA;US)
Radiation Scattering Analysis
In situ chemical analyses of extraterrestrial bodies, 15:3831 (RA;US)
Rare Gases
Noble gases as tracers of the origin and evolution of the Martian atmosphere and the degassing history of the planet, 15:3843 (RA;US)
Sampling
Volcanic rocks and the geologic history of Mars, 15:3840 (RA;US)
Sedimentary Rocks
Examination of Martian sedimentary rocks to understand possible paleo-ocean and its age, 15:3844 (RA;US)
Solar Energy
Solar radiation on Mars, 15:2292 (R;US)
Solar Radiation
Solar radiation on Mars, 15:2292 (R;US)
Spectrometers
In situ XRF and gamma ray spectrometer for Mars sample return mission, 15:3355 (RA;US)
Stable Isotopes
Stable isotopic studies of H,C,N,O and S in samples of Martian origin, 15:3848 (RA;US)
Volatility
Stable isotopic studies of H,C,N,O and S in samples of Martian origin, 15:3848 (RA;US)
Volcanic Rocks
Volcanic rocks and the geologic history of Mars, 15:3840 (RA;US)
Weathering
Martian weathering products as tracers of climate change and atmosphere/hydrosphere evolution on Mars, 15:3833 (RA;US)
What ferric oxide/oxyhydroxide phases are present on Mars, 15:3836 (RA;US)

Zeolites
Zeolites on Mars: Possible environmental indicators in soils and sediments, 15:3835 (RA;US)

MASERS
Operating and environmental characteristics of Sigma Tau hydrogen masers used in the Very Long Baseline Array (VLBA), 15:3162 (RA;US)
Operational parameters for the superconducting cavity maser, 15:3161 (RA;US)

MASS NUMBER
Atomic mass measurements with radioactive beams and/or targets: Where to start, 15:3070 (R;US)

MASS SPECTROSCOPY
Characterisation of molecular boric acid by mass spectrometry and matrix isolation-infrared spectroscopy, 15:3068 (R;GB)
Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:3371 (R;US)
Matrix isolation-infrared and mass spectrometric studies of high-temperature molecules, 15:3039 (R;GB)
Technical and methodical developments, 15:3350 (RA;DE;In German)
UC accelerator mass spectrometry 1: Proceedings, 15:3364 (R;US)

MASS TRANSFER
See also CONVECTION
Boundary processes in the nutrient-bearing stratum of the North Atlantic: Progress report, March 1, 1989–February 28, 1990, 15:3818 (R;US)
Meteorological monitoring for environmental/dose assessment and emergency response modeling: How much is enough?, 15:3488 (R;US)

MASS TRANSIT SYSTEMS
HRIS (Highway Research Information Service) Abstracts. Volume 21, Number 4 - Winter 1988, 15:2713 (R;US)
Revised manual for planning, designing, and operating transitway facilities in Texas. Research report, September 1983-August 1988 (Final), 15:2711 (R;US)
Understanding the dynamics of innovation in urban transit. Final report on Phase 2, 15:2714 (R;US)
Urban Transportation Abstracts. Volume 7, 1988. Report for September 1988-February 1989, 15:2712 (R;US)

MASSACHUSETTS
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report, 15:3573 (R;US)
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report, 15:3574 (R;US)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY ALCATOR
See ALCATOR DEVICE

MASSIVE VECTOR-MESON MODEL
See GLUON MODEL

MASURIUM
See TECHNETIUM

MATERIALS
See also BIOLOGICAL MATERIALS
BUILDING MATERIALS
CARBONACEOUS MATERIALS
COMPOSITE MATERIALS
DOPED MATERIALS
ENVIRONMENTAL MATERIALS
GLAZING MATERIALS
HAZARDOUS MATERIALS
LASER MATERIALS
MATRIX MATERIALS
PHASE CHANGE MATERIALS
RADIOACTIVE MATERIALS
REACTOR MATERIALS
REINFORCED MATERIALS
SEMICONDUCTOR MATERIALS
SHIELDING MATERIALS
THERMONUCLEAR REACTOR MATERIALS
TOXIC MATERIALS
Heat transfer, 15:2805 (B;US)
Hugoniot measurements with the LLNL electric gun facility, 15:3221 (R;US)
Performance characteristics of a three-stage railgun, 15:3220 (R;US)

MATERIALS (ANTIFERROMAGNETIC)
See ANTIFERROMAGNETIC MATERIALS

MATERIALS (BIOLOGICAL)
See BIOLOGICAL MATERIALS

MATERIALS (BUILDING)
See BUILDING MATERIALS

MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS

MATERIALS (DOPED)
See DOPED MATERIALS

MATERIALS (ENVIRONMENTAL)
See ENVIRONMENTAL MATERIALS

MATERIALS (REINFORCED)
See REINFORCED MATERIALS

MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS

MATERIALS (SHIELDING)
See SHIELDING MATERIALS

MATERIALS HANDLING
Safety in transport and storage of radioactive materials, 15:2172 (R;BR;In Portuguese)

MATERIALS TESTING
See also NONDESTRUCTIVE TESTING
A computer-controlled automated test system for fatigue and fracture testing, 15:3215 (R;US)

MATERIALS TESTING REACTOR JAPAN
See JMTR REACTOR

MATHEMATICAL MODELS
See also CLIMATE MODELS
COSMOLOGICAL MODELS
CRYSTAL MODELS
STAR MODELS
Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 15:2233 (R;US)
Solution bias in complex systems modeling, 15:4514 (R;US)

MATHEMATICAL OPERATORS
Iterative methods for nonlinear set-valued operators of the monotone type with applications to operator equations, 15:4267 (R;XA)

MATHEMATICAL SPACE
See also RIEMANN SPACE
Bergman spaces, the Bloch space and the pluriharmonic conjugates in the unit ball of C^n, 15:4264 (R;XA)
D^p spaces on bounded symmetric domains of C^n, 15:4265 (R;XA)
On the continuity of the Nemitsky operator induced by a Lipschitz continuous map, 15:4281 (R;XA)
Projective cohomology over a chain complex, 15:4279 (R;XA)

MATHEMATICS
See also ALGEBRA
GROUP THEORY
Induction on a continuous variable, 15:4269 (R;XA)

MATRICES
A class of "onto" multifunctions, 15:4548 (R;US)
A modified Newton method for unconstrained minimization, 15:4547 (R;US)

MATRIX ISOLATION
Characterisation of molecular boric acid by mass spectrometry and matrix isolation-infrared spectroscopy, 15:3068 (R;GB)
Matrix isolation-infrared and mass spectrometric studies of high-temperature molecules, 15:3039 (R;GB)
New estimates for the thermodynamic functions of molecular boric acid, 15:3069 (R;GB)

MATRIX MATERIALS
Computational simulation of high temperature metal matrix composites cyclic behavior, 15:2976 (R;US)
Fracture-toughness testing of metal-matrix composites, 15:2966 (R;US)

MATTER
See also NUCLEAR MATTER
QUARK MATTER
VOLATILE MATTER
The behavior of matter under nonequilibrium conditions: Fundamental aspects and applications: Progress report, April 15, 1989–April 14, 1990, 15:4262 (R;US)
Ultrahigh brightness XeCl laser system, 15:3170 (BA;US)

MAXWELL EQUATIONS
The free energy of Maxwell-Vlasov equilibria, 15:4309 (R;US)

MEAN-FIELD THEORY
The finite temperature mean-field description and thermal fluctuations, 15:4283 (RA;DE)

MEASURED VALUES
See DATA

MEASURING INSTRUMENTS
See also ANEMOMETERS
METERS
RADIATION DETECTORS
SPECTROMETERS
STRAIN GAGES
THERMOCOUPLES
VISCOSIMETERS
Mechanical design of an infrared imaging system for DIII-D, 15:4414 (R;US)
Power circuit breaker test system, 15:2419 (R;US)

MEASURING METHODS
Evaluation of the thermal performance of the building envelope of existing buildings, 15:2707 (R;FI;In Finnish)

MECHANICAL STRUCTURES
EVP2D- a computer code developed for the eslastoviscoplastic-damage analysis of axyssimetrical and two-dimensional problems, 15:2836 (R;BR;In Portuguese)

MECHANICAL VIBRATIONS
Study on shaft vibration of gas circulators with gas-bearings for HENDEL helium test facility, 15:2454 (R;JP;In Japanese)

MEDICINES
See DRUGS

MEETINGS
Proceedings of Institute for Atomic Energy, Rikkyo University (IAERU) seminar-4, 15:4486 (R;JP)

MELANOCYTES
See ANIMAL CELLS

MELTDOWN
Experimental analysis of the behavior of iodine in the event of hypothetical accidents - iodine partition coefficients (follow-on project). Final report, 15:2555 (R;DE;In German)
Measures for reduction of severe accident consequences: Comprehensive evaluation of the results sponsored by the BMI, 15:2495 (R;DE;In German)

MEMBRANE TRANSPORT
The influence of oscillating electromagnetic fields on membrane structure and function: Synthetic liposome and natural membrane bilayer systems with direct application to the controlled delivery of chemical agents, 15:3802 (R;US)

MEMBRANES
Membrane applications in the food industry: Survey and barriers, 15:2728 (R;US)
Membrane gas separation. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3065 (R;US)
Membrane separation processes for liquid hydrocarbons and gases in the petrochemical industry: A technical case study, 15:2118 (R;US)

MERCAPTOALANINE-BETA
See CYSTEINE

MERCURY
Mercury in lake fish. Linkages to mercury and selenium in mor and historical emissions, 15:3565 (R;SE;In Swedish)

MERCURY 191
Observation of superdeformation in ^{191}Hg, 15:4107 (R;US)

MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

MESSENGER-RNA
Sequence and nitrate regulation of the Arabidopsis thaliana mRNA encoding nitrate reductase, a metalloflavoprotein with three functional domains, 15:3607 (J;US)

METAGALAXY
See UNIVERSE

METAL BUILDINGS
See PREFABRICATED BUILDINGS

METAL INDUSTRY
Best demonstrated available technology (BDAT) background document for cyanide wastes, 15:2770 (R;US)
Detailed control technology survey of a coke-oven plant, 15:2050 (R;US)
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)

METAL-NONMETAL BATTERIES
See also LITHIUM-SULFUR BATTERIES
SODIUM-SULFUR BATTERIES
ZINC-BROMINE BATTERIES
Cell performance of ultra-thin polymer-cathode system: Theoretical energy and power-density projections. Technical report No. 3, July 1988-June 1989, 15:2568 (R;US)
Impedance analysis of ionic transport in polypyrrole-polyazulene copolymer and its charge-discharge characteristics. Technical report, July 1988-June 1989, 15:2571 (R;US)
Li/FeS battery design for an electric van, 15:2586 (B;US)
Rechargeable lithium/polymer cathode batteries. Technical report, July 1988-June 1989, 15:2570 (R;US)
Use of lithium batteries in biomedical devices. Technical report No. 8, July 1988-June 1989, 15:2569 (R;US)

METALS
See also ALKALI METALS
ALUMINIUM
CADMIUM
GERMANIUM
LEAD
MERCURY
RARE EARTHS
THALLIUM
TRANSITION ELEMENTS
ZINC
Acoustic emission during integranular stress corrosion cracking, 15:2849 (R;US)
Analytic embedded atom method model for bcc metals, 15:2876 (J;US)
Dislocation-hydrogen correlation in metals, 15:4203 (R;US)
Distance of the image plane from metal surfaces, 15:2890 (J;US)
Dynamically compressed metals - theory. Final report, 1 February 1986-30 April 1989, 15:4200 (R;US)
Empirical electron-phonon coupling constants and anisotropic electrical resistivity in hcp metals, 15:2885 (J;US)
First-principles molecular dynamics for metals, 15:4247 (J;US)
Heavy metals in drinking water: Standards, sources, and effects. January 1978-September 1989 (Citations from the Life Sciences Collection data base). Report for January 1978-September 1989, 15:3564 (R;US)
MHD [Magnetohydrodynamics] Integrated Topping Cycle Project: Fourth quarterly technical progress report, May 1, 1988–July 31, 1988, 15:2649 (R;US)
Modeling of heat capacities of metals, 15:2867 (J;NL)
Nanophase materials assembled from atomic clusters, 15:2824 (R;US)
Recovery of metals using aluminum displacement, 15:2741 (R;US)

METASTASES
Radionuclidetherapy of metastases of thyroid cancer to lungs, 15:3641 (RA;SU;In Russian)

METEORITES
Crystal fractionation in the SNC meteorites: Implications for sample selection, 15:3846 (RA;US)
Overview of Mars: SNC meteorite results, 15:3847 (RA;US)

METEOROLOGY
Meteorological monitoring for environmental/dose assessment and emergency response modeling: How much is enough?, 15:3488 (R;US)
METERS
See also FLOWMETERS
LANSIR: An instrument for measuring the light-scattering properties of laminate membrane mirrors, 15:2350 (BA;US)
METHANE
Biological and biochemical methane reactions. Final report, March 1986-March 1989, 15:2268 (R;US)
Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)
Development of the foundation for direct conversion of methane to methanol, 15:2271 (B;US)
Enhanced flame stability and soot radiation using electric fields. Final report, July 1986-January 1989, 15:3114 (R;US)
Gas content in sealed Argonne Premium Coal Samples, 15:2051 (R;US)
Methane drainage from gassy Western US coal seams, 15:2083 (R;US)
Photoconversion of inorganics to methane. Final topical report, October 1987-February 1989, 15:2267 (R;US)
Proceedings of the natural gas R&D contractors review meeting, 15:2142 (R;US)
Sources of methane in China: A program to estimate the emissions from rice paddies, biogas pits and urban areas: Annual progress report, 15:3411 (R;US)
Tables for the thermophysical properties of methane. Technical note, 15:2151 (R;US)
METHANE HYDRATES
See GAS HYDRATES
METHANOGENIC BACTERIA
Molecular biology and physiology of methanogenic archaebacteria. Annual report, July 1988-June 1989, 15:3596 (R;US)
METHANOL
Assessment of costs and benefits of flexible and alternative fuel use in the US transportation sector: Technical report three: Methanol production and transportation costs, 15:2618 (R;US)
Biological and biochemical methane reactions. Final report, March 1986-March 1989, 15:2268 (R;US)
Development of the foundation for direct conversion of methane to methanol, 15:2271 (B;US)
Key chemicals from synthesis gas - development of novel zeolites as catalysts for conversion of methanol into hydrocarbons, 15:2028 (R;DE;In German)
METHANOL FUELS
Methanol fuel M 100. Study into boundary conditions and optimisation of constituents, 15:2785 (R;DE;In German)
METHANOTROPHIC BACTERIA
Biological and biochemical methane reactions. Final report, March 1986-March 1989, 15:2268 (R;US)
In-situ aquifer restoration of chlorinated aliphatics by methanotrophic bacteria. Research report, 1 May 1985-30 April 1989, 15:3554 (R;US)
METHOXYBENZENE
See ANISOLE
METHYL ALCOHOL
See METHANOL
METHYL FLUORIDE
New techniques for positron emission tomography in the study of human neurological disorders: Progress report, June 15, 1987–November 15, 1989, 15:3616 (R;US)
METHYL METHACRYLATE
Gastric response to methyl methacrylate vapor. Progress report, 15:3769 (R;US)
METHYL PHENYL ETHER
See ANISOLE
METHYL TRANSFERASES
Effect of gamma radiation on DNA methylation, 15:3690 (R;US)
METHYL-FUEL
See METHANOL
METHYLBENZENE
See TOLUENE
METHYLENE CHLORIDE
Methods used in the United States for the assessment and management of health risk due to chemicals, 15:3773 (R;US)
Source characterization and control technology assessment of methylene chloride emissions from Eastman Kodak Company, Rochester, NY. Final report, July 1988-April 1989, 15:3452 (R;US)
METROPOLITAN AREAS
See URBAN AREAS
MHD CHANNELS
MHD [Magnetohydrodynamics] Integrated Topping Cycle Project: Fourth quarterly technical progress report, May 1, 1988–July 31, 1988, 15:2649 (R;US)
MHD EQUILIBRIUM
Lower hybrid current drive and suppression of MHD instabilities on WT-3, 15:4322 (RA;JP)
MICELLAR-POLYMER FLOODING
See MICROEMULSION FLOODING
MICROBIAL ENHANCED OIL RECOVERY
See MICROBIAL EOR
MICROBIAL EOR
Selection of an effective biocide and toxicity evaluation for a specific MEOR [microbial enhanced oil recovery] microbial formulation, 15:2114 (R;US)
MICROBIAL FLORA
See MICROORGANISMS
MICROELECTRONICS
Interplanetary particle environment. Proceedings of a conference, 15:3361 (R;US)
MICROEMULSION FLOODING
Analysis, development and investigations into phase behaviour of surfactant systems for de-oiling high-salinitiy reservoirs with reference to the Bockstedt field of Wintershall AG. Final report, 15:2110 (R;DE;In German)
MICROFLORA
See MICROORGANISMS
MICROORGANISMS
See also BACTERIA
Biosorption of molybdenum and chromium, 15:3546 (R;US)
Interaction between thermophilic microorganisms and crude oils: Recent developments, 15:2107 (R;US)
Selection of an effective biocide and toxicity evaluation for a specific MEOR [microbial enhanced oil recovery] microbial formulation, 15:2114 (R;US)
The biocorrosion of copper by biopolymers as examined in situ, in real time FT-IR/CIR/ATR in conjunction with pre and post XPS/AES, 15:2832 (R;US)
MICROSTRUCTURE
See also GRAIN BOUNDARIES
Atomic matching across internal interfaces, 15:4207 (R;US)
MICROWAVE POWER TRANSMISSION
Microwave coupling phenomenology of pc [printed-circuit] boards, 15:3227 (R;US)
MICROWAVE RADIATION
Experimental study of microwave transmission through a decaying plasma. Final report, January 1986-February 1988, 15:3936 (R;US)
Intense microwave radiation from a repetitive backward-wave oscillator driven by a relativistic electron beam, 15:4182 (J;US)
MIGRATION
Migration of radio-marked whooping cranes from the Aransas-wood buffalo population: Patterns of habitat use, behavior, and survival. Technical report, 15:2602 (R;US)
MIGRATION (RADIONUCLIDE)
See RADIONUCLIDE MIGRATION
MILITARY EQUIPMENT
Evaluate and characterize mechanisms controlling transport, fate, and effects of army smokes in the aerosol wind tunnel: Transport, transformations, fate, and terrestrial ecological effects of hexachloroethane obscurant smokes: Final report, 15:3463 (R;US)
Human factors evaluation of electroluminescent display #1, 15:3126 (R;US)

INEL [Idaho National Engineering Laboratory] support to modernization efforts at the Aberdeen Proving Ground, 15:4515 (R;US)
Neutron-radiography system for field use. Final report, 15:3212 (R;US)
US Marine 3rd Tank Battalion lubrication evaluation under hot ambient temperatures at Twenty-Nine Palms, California. Interim report, April-September 1988, 15:2122 (R;US)

MILITARY FACILITIES
Compliance testing of the Eglin AFB (Air Force Base) asphalt-concrete Batch Plant, Eglin AFB, Florida. Final report, 5-11 March 1989, 15:3403 (R;US)
Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska, 15:2717 (R;US)
Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska, 15:2716 (R;US)
Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska, 15:2721 (R;US)
Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska, 15:2723 (R;US)
Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska, 15:2722 (R;US)
Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska, 15:2720 (R;US)
Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska, 15:2719 (R;US)
Installation-Restoration Program Preliminary Assessment, Naknek Recreational Camps, Alaska, 15:2718 (R;US)
Installation-Restoration Program Stage 3. McClellan AFB, California. Remedial investigation/feasibility study ground-water sampling and analysis program, January through March 1989 data summary. Final report, January-March 1989, 15:3542 (R;US)
Properties of F-34 (JP-8) fuel for 1988. Summary report, January-December 1988, 15:2119 (R;US)
Review of facility-technology options and their development status. Final report, 15:2604 (R;US)
Waste-water characterization survey, Little Rock AFB, Arizona. Final report, 11-24 July 1988, 15:3577 (R;US)

MILITARY PERSONNEL
Effects of atmospheric mix and toxic fumes on military performance, 15:3777 (R;US)
Human-health studies of carbon monoxide (CO) under conditions of military weapons systems crewman exposures. Protocol 1: Formation of cohb. Final report, September 1982-March 1985, 15:3755 (R;US)
Navy Radon Assessment and Mitigation Program progress report, September 1988–May 1989, 15:2673 (R;US)

MILK
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)

MINE SHAFTS
See also ABANDONED SHAFTS
The Waste Isolation Pilot Plant (WIPP) Seal System Performance Program, 15:2236 (R;US)

MINE-MOUTH GENERATING PLANTS
See COAL MINES
FOSSIL-FUEL POWER PLANTS

MINERAL OIL
See LUBRICANTS

MINERAL WASTES
Proceedings of the conference: reclamation, a global perspective, 15:2079 (R;CA)

MINERALS
See also ZEOLITES
Characterization of the emerald of Santa Terezinha de Goias by spectroscopy, fluorescence and X-ray difraction, 15:4226 (R;BR;In Portuguese)
Mineral matter transformations and slagging in a semi-industrial furnace, 15:2100 (R;NL)
Review on mineral matter transformations and slagging in pulverized coal combustion, 15:2099 (R;NL)

MINING
See also COAL MINING
SURFACE MINING
UNDERGROUND MINING
Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)

MIRRORS
LANSIR: An instrument for measuring the light-scattering properties of laminate membrane mirrors, 15:2350 (BA;US)

MISGURNUS
See FISHES

MISSILES
See also CRUISE MISSILES
Tracking performance evaluation. Final report, 1 December 1987-31 August 1988, 15:3379 (R;US)

MIXED CARBIDE FUELS
Fabrication of uranium-plutonium mixed carbide fuel pins for JMTR irradiation capsules, 84F-10A, 84F-12A and 87F-2A, 15:2461 (R;JP;In Japanese)

MIXED OXIDE FUELS
Studies of the ternary phase diagram U-Pu-O between 1000 and 2000deg C. Structural and physico-chemical properties of $Pu_xU_yO_z$ mixed oxides with a view to applications as fuel, 15:2919 (R;DE;In German)

MM-0011
See NICKEL BASE ALLOYS

MODELS (COSMOLOGICAL)
See COSMOLOGICAL MODELS

MODELS (CRYSTAL)
See CRYSTAL MODELS

MODELS (MATHEMATICAL)
See MATHEMATICAL MODELS

MODELS (OPTICAL)
See OPTICAL MODELS

MODELS (PLASMA)
See PLASMA SIMULATION

MODELS (SHELL)
See SHELL MODELS

MODELS (STAR)
See STAR MODELS

MOISTURE
Development of a moisture meter for milled layer, 15:2087 (R;FI;In Finnish)

MOLDS
See FUNGI

MOLECULAR BEAMS
A finite temperature theory of rotationally inelastic diffraction: H_2, HD, and D_2 on Cu(100), 15:4243 (J;US)

MOLECULAR BIOLOGY
Molecular biology and physiology of methanogenic archaebacteria. Annual report, July 1988-June 1989, 15:3596 (R;US)

MOLECULAR IONS
See also OXONIUM IONS
Ar^+_3 photodissociation and its mechanisms, 15:3097 (J;US)

MOLECULAR ORBITAL MODEL
See MOLECULES

MOLECULE COLLISIONS
See also ATOM-MOLECULE COLLISIONS
ION-MOLECULE COLLISIONS
International bulletin on atomic and molecular data for fusion. No. 39, 15:4317 (R;XA)

MOLECULES
See also POLYATOMIC MOLECULES
Measurement of transition moments between molecular excited electronic states using the Autler-Townes effect, 15:3175 (J;US)
Molecular dynamics studies of aromatic hydrocarbon liquids: Progress report, March 1, 1989–February 28, 1990, 15:4211 (R;US)

MOLLUSCS
See also SNAILS
Parallel processing and learning in simple systems. Final report, 10 January 1986-14 January 1989, 15:3595 (R;US)

MOLTEN CARBONATE FUEL CELLS
Development of high-efficiency molten carbonate fuel cell. Evaluation of stack performance and clarification of degradation mechanism at high fuel utilization, 15:2656 (R;JP;In Japanese)
MOLTEN SALT COOLANTS
See MOLTEN SALTS
MOLTEN SALTS
See also FLIBE
Nuclear magnetic resonance in molten salts, 15:4202 (R;US)
MOLYBDENUM
Biosorption of molybdenum and chromium, 15:3546 (R;US)
Comprehensive characterization studies of sulfided molybdenum catalysts: Final progress report, 15:2828 (R;US)
Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 8, June 15, 1989–September 15, 1989, 15:2021 (R;US)
Enhanced coal liquefaction by low-severity catalytic reactions: Final report, 15:2026 (R;US)
Hydrogen and helium in metals: positron lifetime experiments. Quarterly report 3. quarter 1987, 15:2839 (R;FI)
MOLYBDENUM 100 REACTIONS
Measurement of g-factors in Yb isotopes, 15:4103 (RA;DE)
MOLYBDENUM 100 TARGET
α-scattering on ^{100}Mo, 15:4092 (RA;DE;In German)
γ-multiplicity distributions for fusion reactions at and below the barrier, 15:4095 (RA;DE;In German)
MOLYBDENUM 96 TARGET
γ-multiplicity distributions for fusion reactions at and below the barrier, 15:4095 (RA;DE;In German)
MOLYBDENUM 98
Search for 2γ decay of the first excited 0^+ state in ^{98}Mo, 15:4094 (RA;DE;In German)
MOLYBDENUM 98 REACTIONS
Study of multi-fragmentation in collisions of heavy ions, 15:4096 (RA;DE;In German)
MOLYBDENUM 98 TARGET
Study of multi-fragmentation in collisions of heavy ions, 15:4096 (RA;DE;In German)
MOLYBDENUM 99
Target and method for the production of fission product molybdenum-99, 15:3105 (P;US)
MOLYBDENUM ALLOYS
See also STEEL-CR9MONBV
High-temperature interdiffusion and phase equilibria in U-Mo, 15:2868 (J;NL)
Low cross-section Mo-Nb thermocouples for nuclear application: The state-of-the-art, 15:2831 (R;US)
MOLYBDENUM IONS
Direct and resonance contributions to electron-impact excitation of n=2 to n=3 transitions in neonlike ions, 15:3907 (J;US)
MOLYBDENUM SULFIDES
An investigation of coal-oil reaction pathways using model compounds, 15:2049 (B;US)
MOMENTUM (LINEAR)
See LINEAR MOMENTUM
MONITORING (RADIATION)
See RADIATION MONITORING
MONITORS (AIR POLLUTION)
See AIR POLLUTION MONITORS
MONITORS (BEAM)
See BEAM MONITORS
MONITORS (RADIATION)
See RADIATION MONITORS
MONITORS (REACTOR)
See REACTOR CONTROL SYSTEMS
MONOCRYSTALS
Analysis by X-ray diffraction of new esquiatosomicides, 15:4222 (R;BR;In Portuguese)
Anisotropic constitutive modeling for nickel base single crystal superalloy Rene N4 at 982 C, 15:2842 (RA;US)
Constitutive modelling of single crystal and directionally solidified superalloys, 15:2843 (RA;US)
High temperature constitutive and crack initiation modeling of coated single crystal superalloys, 15:2845 (RA;US)
Process for single-crystal growth of high T(c) superconductors, 15:2965 (P;US)
MOS TRANSISTORS
Bias and oxide thickness dependence of trapped-charge buildup in MOS (metal oxide semiconductors) devices. Technical report, 15:3222 (R;US)
MULTI-PHOTON PROCESSES
Absolute rate measurements of two-photon process of gases, liquids, and solids, 15:3174 (J;US)
MULTICHARGED IONS
Relativistic cross sections for excitation of highly charged ions to specific magnetic sublevels by an electron beam, 15:3896 (R;US)
MULTIPLE PRODUCTION
Multiplicity distribution of particles from string fragmentation calculated in a statistical model, 15:3994 (RA;DE)
Rapidity distribution and scaling violation in a statistical approach to string fragmentation, 15:3993 (RA;DE)
MULTIPLEXERS
Fiber-optic wavelength-division multiplexing and demultiplexing using volume holographic gratings, 15:3373 (J;US)
MULTIPLICATION FACTORS
Subcriticality of two uranyl nitrate slab tanks spaced in air by the ^{252}CF-source-driven noise analysis method, 15:3125 (R;US)
MULTIPOLES
Random errors in the magnetic field coefficients of superconducting quadrupole magnets, 15:3327 (BA;US)
MULTIPROCESSING
See PARALLEL PROCESSING
MULTIPROCESSORS
See ARRAY PROCESSORS
MULTIWIRE DRIFT CHAMBERS
See DRIFT CHAMBERS
MUNICIPAL BUILDINGS
See PUBLIC BUILDINGS
MUNICIPAL WASTES
Analytical methods necessary to implement risk-based criteria for chemicals in municipal sludge, 15:2775 (R;US)
Incineration studies. October 1985-September 1989 (Citations from the COMPENDEX data base). Report for October 1985-September 1989, 15:2778 (R;US)
Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action, 15:3591 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 3): Wildcat Landfill, DE. (Second Remedial Action), November 1988. Final report, 15:3535 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)
Wisconsin waste reduction and recovery plan, 15:2745 (R;US)
MUON NEUTRINOS
[A high sensitivity search for MU Gamma: The Mega experiment at LAMPF]: Progress report, January 15, 1989–October 15, 1989, 15:3952 (R;US)
MUON REACTIONS
Deep-inelastic myon-nucleus scattering at the CERN SPS; EMC and NMC Collaboration, 15:3956 (RA;DE;In German)

MUON-CATALYZED FUSION
Interpretation of recent LAMPF results on D T MU formation, 15:4073 (R;US)
Muon spectrum and convoy effects after muon-catalyzed fusion, 15:4177 (J;US)
MUON-PROTON INTERACTIONS
Deep-inelastic myon-nucleus scattering at the CERN SPS; EMC and NMC Collaboration, 15:3956 (RA;DE;In German)
Multiplicity distribution of particles from string fragmentation calculated in a statistical model, 15:3994 (RA;DE)
Rapidity distribution and scaling violation in a statistical approach to string fragmentation, 15:3993 (RA;DE)
MUONS
[A high sensitivity search for MU Gamma: The Mega experiment at LAMPF]: Progress report, January 15, 1989–October 15, 1989, 15:3952 (R;US)
MUSCULAR TISSUE
See TISSUES
MUSEUMS
See EDUCATIONAL FACILITIES
MUSTARD (NITROGEN)
See NITROGEN MUSTARD
MUTAGEN SCREENING
Utility of short-term tests for genetic toxicity, 15:3612 (R;US)
MUTAGENS
Application of a simple short-term bioassay for the identification of genotoxins from hazardous wastes, 15:3782 (R;US)
Complex mixtures of urban air pollutants: Identification and comparative assessment of mutagenic and tumorigenic chemicals and emission sources, 15:3784 (R;US)
Genetic activity profiles: Use in management of risk from genotoxic substances in the environment, 15:3766 (R;US)
Genetic-activity profiles and hazard assessment, 15:3768 (R;US)
Use of genotoxic activity profiles in assessment of carcinogenesis and transmissible genetic effects, 15:3775 (R;US)
Utility of short-term tests for genetic toxicity, 15:3612 (R;US)
MUTATIONS
See also CHROMOSOMAL ABERRATIONS
The current status of two-dimensional electrophoresis in germ cell mutation research, 15:3365 (R;US)

N

N CODES
Time domain structural response calculations for vertical axis wind turbines, 15:2401 (BA;US)
NAPAP
Development of an inventory of materials potentially sensitive to ambient atmospheric acidity in the South Coast Air Basin. Final report, 15:3558 (R;US)
Development of the advanced utility simulation model. Report for May 1985-September 1988, 15:2430 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Southern Blue Ridge Province data base, 15:3553 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Northeast data base, 15:3555 (R;US)
Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989, 15:3460 (R;US)
US and Canadian emissions inventory, 1985. Report for March-September 1988, 15:3442 (R;US)
NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM
See NAPAP
NATIONAL DEFENSE
See also BALLISTIC MISSILE DEFENSE
CIVIL DEFENSE
Can the U.S. economy survive a few nuclear weapons, 15:2804 (J;US)
Concerning advanced architectures for strategic defense, 15:2802 (R;US)
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
See NIOSH
NATIONAL REACTOR TESTING STATION
See IDAHO NATIONAL ENGINEERING LABORATORY
NATIONAL REACTOR TESTING STATION BURST FACILITY
See PBF REACTOR
NATURAL CIRCULATION
See NATURAL CONVECTION
NATURAL CONVECTION
Time-dependent free convection in low Prandtl number fluids, 15:3207 (R;US)
NATURAL GAS
See also LIQUEFIED NATURAL GAS
Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988, 15:2418 (R;US)
Canadian natural gas: Export potential, 15:2144 (R;CA)
Caterpillar 3406 spark-ignited natural-gas-engine emissions on EPA (Environmental Protection Agency) heavy-duty transient test cycle. Topical report, March-December 1988, 15:2801 (R;US)
Commercial building research workshop. July 30-31, 1986, 15:2145 (R;US)
International energy annual, 1988, 15:2630 (R;US)
Laser probes of natural gas ignition chemistry. Annual report, January-December 1988, 15:2153 (R;US)
Natural gas monthly, August 1989, 15:2629 (R;US)
Proceedings of the natural gas R&D contractors review meeting, 15:2142 (R;US)
Regional application of natural-gas-fired combined-cycle power generation, 15:2759 (R;US)
Statistics of interstate natural gas pipeline companies, 1988, 15:2149 (R;US)
NATURAL GAS DEPOSITS
Analysis of natural fractures observed by borehole video camera in a horizontal well, 15:2140 (BA;US)
Continuation of gas technology, basic research, and education. Final report, August 15, 1985-August 15, 1988, 15:2137 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2, 15:2130 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices, 15:2131 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 1. Final executive summary, 15:2129 (R;US)
NATURAL GAS DISTRIBUTION SYSTEMS
Development of short-term tests for evaluating plastic gas-piping materials. Annual report, January-December 1984, 15:2150 (R;US)
NATURAL GAS GATHERING SYSTEMS
See NATURAL GAS DISTRIBUTION SYSTEMS
NATURAL GAS INDUSTRY
Continuation of gas technology, basic research, and education. Final report, August 15, 1985-August 15, 1988, 15:2137 (R;US)
Review of physical science research, 1979-1988, 15:2136 (R;US)
NATURAL GAS WELLS
Inducing multiple hydraulic fractures from a horizontal wellbore, 15:2147 (BA;US)
Understanding the effect of natural fractures on the hydrofracture stimulation of gas reservoirs, 15:2148 (BA;US)
NATURAL LIGHTING
See DAYLIGHTING
NAVIGATION
Autonomous land navigation in a structured environment, 15:3138 (R;US)
NEGATONS
See ELECTRONS
NEGATRONS
See ELECTRONS
NEODYMIUM
Spectrophotometric investigation of addition compounds between neodymium (III) and europium (III) perchorates and

hexafluorophosphate and cyclic ligants with two oxygen in opposite position, 15:3055 (R;BR;In Portuguese)

NEODYMIUM IONS
Intra-stark relaxation of Nd^{3+} in silicate glass: Subpicosecond accumulated photon echo experiments, 15:4237 (R;US)

NEODYMIUM LASERS
A novel approach to a PPM-modulated frequency-doubled electro-optic cavity-dumped Nd:YAG laser, 15:3163 (RA;US)
Diode-pumped laser research, 15:3164 (RA;US)

NEODYMIUM SULFIDES
Thermophysical properties of the lanthanide sesquisulfides. I. Schottky functions and magnetic and electronic properties of γ-La_2S_3, γ-Ce_2S_3, γ-Nd_2S_3, and γ-Gd_2S_3, 15:3021 (J;US)

NEOPLASMS
See also CARCINOMAS
Case-control study of bladder cancer in Massachusetts among populations receiving chlorinated and chloraminated drinking water, 15:3771 (R;US)

Biomedical Radiography
Methods of improving the quality of examinations in radiodiagnosis, 15:3632 (RA;SU;In Russian)

Chemotherapy
Combined treatment of breast cancer, 15:3655 (RA;SU;In Russian)
Influence of local UHF-hyperthermia on frequency of postradiation larynx chondroperichondrites, 15:3659 (RA;SU;In Russian)

Fractionated Irradiation
Local complications of radiotherapy in macrofractionated irradiation of patients with larynx cancer, 15:3664 (RA;SU;In Russian)

Hyperthermia
Influence of local UHF-hyperthermia on frequency of postradiation larynx chondroperichondrites, 15:3659 (RA;SU;In Russian)
Thermoradiotherapy of patients with recurrences of rectum cancer, 15:3666 (RA;SU;In Russian)

Magnetic Resonance
Diagnostic possibilities of MR-tomography in revealing and evaluation of hematoma state, 15:3626 (RA;SU;In Russian)

Radioinduction
The Radiological Research Accelerator Facility: Progress report, December 1, 1988–November 30, 1989, 15:3695 (R;US)

Radiotherapy
A physicochemical aspects of radioprotection and sensitized cancer radiotherapy, 15:3707 (RA;DE)
Change in proliferative activity of squamous cell and adenogenic carcinomas in the process of radiotherapy as a possible radiosensitivity index, 15:3657 (RA;SU;In Russian)
Chemoluminescence and antioxidative blood activity in patients with rectum cancer in radiotherapy, 15:3739 (RA;SU;In Russian)
Combined treatment of breast cancer, 15:3655 (RA;SU;In Russian)
Contemporary possibilities of combined treatment of rectum cancer, 15:3636 (RA;SU;In Russian)
Efficiency of larynx cancer radiotherapy in dose multifractionating, 15:3637 (RA;SU;In Russian)
Evolution of radiotherapy methods in breast cancer, 15:3640 (RA;SU;In Russian)
Individualization of preoperative radiotherapy in esophagus cancer, 15:3644 (RA;SU;In Russian)
Influence of local UHF-hyperthermia on frequency of postradiation larynx chondroperichondrites, 15:3659 (RA;SU;In Russian)
Intracavitary radiotherapy of malignant tumors of rectum, 15:3653 (RA;SU;In Russian)
Local complications of radiotherapy in macrofractionated irradiation of patients with larynx cancer, 15:3664 (RA;SU;In Russian)
Local radiation injuries, 15:3736 (RA;SU;In Russian)
Neutron capture therapy for melanoma, 15:3615 (R;US)
Possibilities of radiation and combined therapy in treatment of patients with esophagus cancer, 15:3639 (RA;SU;In Russian)
Prospects for development of radiotherapy of patients with esophagus cancer (role of modifying factors), 15:3643 (RA;SU;In Russian)
Radiation changes following treatment of inoperable locally disseminated mammary gland neoplasms when using proton beams, 15:3675 (RA;SU;In Russian)
Radiotherapy in combined treatment of patients with breast cancer of early stages, 15:3654 (RA;SU;In Russian)
Thermoradiotherapy of patients with recurrences of rectum cancer, 15:3666 (RA;SU;In Russian)
Thymaline as a factor of homeostasis correction in the process of radiotherapy, 15:3652 (RA;SU;In Russian)

Surgery
Combined treatment of breast cancer, 15:3655 (RA;SU;In Russian)
Contemporary possibilities of combined treatment of rectum cancer, 15:3636 (RA;SU;In Russian)
Possibilities of radiation and combined therapy in treatment of patients with esophagus cancer, 15:3639 (RA;SU;In Russian)
Radiotherapy in combined treatment of patients with breast cancer of early stages, 15:3654 (RA;SU;In Russian)

Tomography
Diagnostic possibilities of MR-tomography in revealing and evaluation of hematoma state, 15:3626 (RA;SU;In Russian)

NEPTUNIUM 237 TARGET
Delayed-fission properties of neutron-deficient americium nuclei, 15:4120 (R;US)

NETWORKS (COMPUTER)
See COMPUTER NETWORKS

NEUTRAL ATOM BEAM INJECTION
Neutral beam current drive scaling in DIII-D, 15:4331 (RA;JP)

NEUTRAL BEAM SOURCES
In situ measurement of neutral beam components using the Doppler-shifted H_α emissions in Heliotron E, 15:4345 (R;JP)

NEUTRETTOS
See MUON NEUTRINOS

NEUTRINO DETECTION
Gallium solar neutrino experiment (project 'GALLEX'), 15:3347 (RA;DE;In German)

NEUTRINO-DEUTERON INTERACTIONS
Neutrino disintegration of deuterium, 15:3985 (R;US)

NEUTRINOS
See also ELECTRON NEUTRINOS
MUON NEUTRINOS
SOLAR NEUTRINOS
Heavy-Majorana-neutrino production, 15:4010 (J;US)
The low energy frontier in high energy particle physics, 15:3332 (R;US)

NEUTRON CAPTURE
See NEUTRON REACTIONS

NEUTRON CAPTURE THERAPY
Thiourea derivatives: Process for their production and for their use for neutron capture therapy of malignant melanomas, 15:3618 (TG;US)

NEUTRON DETECTORS
High-efficiency fast-neutron detector. Memorandum report, 15:3329 (R;US)

NEUTRON DIFFRACTOMETERS
Electronically focused time-of-flight powder diffractometers at the Intense Pulsed Neutron Source, 15:3358 (J;DK)

NEUTRON DIFFUSION EQUATION
Parallel algorithms for solving the diffusion equation by finite elements methods and by nodal methods, 15:2470 (R;FR;In French)

NEUTRON MATTER
See NUCLEAR MATTER

NEUTRON RADIOGRAPHY
Digital image processing for real-time neutron radiography and its applications, 15:2252 (RA;JP;In Japanese)
Neutron radiography and its image resolutions, 15:2250 (RA;JP;In Japanese)
Neutron radiography application to archaeological and ethnological objects, 15:3042 (RA;JP;In Japanese)
Neutron radiography of the irradiated nuclear fuels, 15:2477 (RA;JP;In Japanese)
Neutron-radiography system for field use. Final report, 15:3212 (R;US)

Studies and applications of neutron radiography with film methods, 15:2251 (RA;JP;In Japanese)
Transportable thermal neutron radiography devices, 15:2253 (RA;JP;In Japanese)

NEUTRON REACTIONS
See also FAST FISSION
THERMAL FISSION
(n,p) reactions and the nuclear structures, 15:4087 (RA;JP)
Measurement of (n,p) reactions using the spectrograph DUMAS and an apparatus for high resolution (n,p) experiments at intermediate energy, 15:3356 (RA;JP;In Japanese)
Measurement of the analyzing power of $p(n,\gamma)d$ reaction, 15:4074 (RA;JP)
Proceedings of the workshop on neutron scattering and neutron reactions, 15:4164 (R;JP)
Progress report on nuclear data activities in India for the period from July 1987 to December 1988, 15:4062 (R;IN)
Radiation-transport calculations of a simple structure using the vehicle code system with 69-group cross sections and the Monte Carlo neutron and photon code. Final report, 15:4178 (R;US)
Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987, 15:4416 (R;XA)

NEUTRON SOURCES
Neutron range spectrometer, 15:3359 (P;US)
Optimization of the testing volumes with respect to neutron flux levels in the two-target high flux D-Li neutron source for the international fusion materials irradiation facility, 15:4435 (R;US)

NEUTRON SPECTROMETERS
Neutron range spectrometer, 15:3359 (P;US)

NEUTRON TRANSPORT
Radiation-transport calculations of a simple structure using the vehicle code system with 69-group cross sections and the Monte Carlo neutron and photon code. Final report, 15:4178 (R;US)

NEUTRON-ANTINEUTRON INTERACTIONS
Neutron-antineutron oscillations in nuclei, 15:4070 (R;US)

NEUTRONS
See also FAST NEUTRONS
FISSION NEUTRONS
Neutron electric dipole moment in lattice QCD, 15:4053 (J;US)

NEW ENGLAND
See FEDERAL REGION I

NEWTON METHOD
A modified Newton method for unconstrained minimization, 15:4547 (R;US)

NICKEL
Continuous high-temperature lubrication of ceramics by carbon generated catalytically, 15:2900 (R;US)
Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 8, June 15, 1989–September 15, 1989, 15:2021 (R;US)
Hydrogen and helium in metals: positron lifetime experiments. Quarterly report 3. quarter 1987, 15:2839 (R;FI)
Optical second harmonic generation from Ni(110) with adsorbed CO, 15:2879 (J;US)
Pulsed laser mixing of metal overlayers on ceramics, 15:2943 (BA;US)
Thermodynamic properties of fcc transition metals as calculated with the embedded-atom method, 15:2883 (J;US)

NICKEL 57
Decay of ^{57}Ni, 15:4084 (R;BR;In Portuguese)

NICKEL 58 REACTIONS
Transfer reactions with very heavy ions. Quarterly report 3. quarter 1987, 15:4106 (R;FI)

NICKEL 58 TARGET
Emission of fast protons in (e,e'p) coincidence experiments, 15:4085 (RA;DE;In German)
The interference term between nuclear charge and nuclear current matrix elements of the E1 giant resonance in ^{12}C and ^{58}Ni, 15:4075 (RA;DE;In German)

NICKEL 64 TARGET
Measurement of g-factors in Yb isotopes, 15:4103 (RA;DE)
Preequilibrium emission of neutrons in central heavy-ion collisions at 15-20 MeV/A bombarding energy, 15:4086 (RA;DE;In German)

NICKEL ALLOYS
See also ALLOY-FE46NI33CR21
NICKEL BASE ALLOYS
NITINOL
Electronic origin of the intermediate phase of NiTi, 15:2892 (J;US)
Spin dynamics of amorphous $Fe_{90-x}Ni_xZr_{10}$, 15:2819 (R;US)

NICKEL BASE ALLOYS
See also HAYNES 188 ALLOY
Acoustic emission during integranular stress corrosion cracking, 15:2849 (R;US)
Anisotropic constitutive modeling for nickel base single crystal superalloy Rene N4 at 982 C, 15:2842 (RA;US)
Constitutive modelling of single crystal and directionally solidified superalloys, 15:2843 (RA;US)
Magnetic viscosity in Ni/Cu compositionally-modulated alloys, 15:2812 (R;US)

NICKEL-HYDROGEN BATTERIES
Development of advanced battery systems for vehicle applications, 15:2587 (B;US)

NICKEL-IRON BATTERIES
See IRON-NICKEL BATTERIES

NIGHTGLOW
See AIRGLOW

NIOBIUM
Niobium and niobium nitride contacts on semiconducting material, 15:3233 (P;US)
Study of niobium corrosion in alkaline medium, 15:2837 (R;BR;In Portuguese)

NIOBIUM ALLOYS
Exploratory study of niobium, titanium, zirconium, and tantalum aluminides. Final report, 1 March 1988-31 May 1989, 15:2807 (R;US)
Lattice dynamics of quenched diffuse ω phase in $Zr_{0.8}Nb_{0.2}$, 15:2884 (J;US)
Low cross-section Mo-Nb thermocouples for nuclear application: The state-of-the-art, 15:2831 (R;US)
Stress corrosion cracking of an uranium-6 weight per cent niobium in gaseous oxygen, nitrogen and hydrogen, 15:2814 (R;FR;In French)

NIOBIUM CARBIDES
Structure of niobium carbides, 15:2934 (TJ;US)

NIOBIUM IONS
Test of predicted $\Delta n>1$ *L*-shell dielectronic-recombination cross sections, 15:3926 (J;US)

NIOBIUM NITRIDES
Niobium and niobium nitride contacts on semiconducting material, 15:3233 (P;US)
Plasma-activated ion-beam reactive sputtering of NbN thin films, 15:2898 (R;US)

NIOBIUM OXIDES
Method of fabricating optical waveguides by ion implantation doping, 15:2964 (P;US)
Optical waveguide formation by ion implantation of Ti or Ag, 15:2940 (BA;US)

NIOSH
National Institute for Occupational Safety and Health (NIOSH): Health Hazard Evaluation Reports. January 1987-September 1989 (Citations from the NTIS data base). Report for January 1987-September 1989, 15:3685 (R;US)
Technique for chest radiography for pneumoconiosis, 15:3678 (R;US)

NITINOL
Battery actuation of NITINOL at sub-zero temperatures, 15:2572 (R;US)

NITRATES
See also PETN
SILVER NITRATES
THORIUM NITRATES
URANYL NITRATES
An acid rain study in the Washington, D.C. area, 15:3472 (J;US)

Participation in the MAP3S precipitation chemistry network: Progress report, August 1, 1988–July 31, 1989, 15:3410 (R;US)

NITRIC OXIDE
Adsorption of NO on diamond C(111)-(2×1) by band-gap excitation, 15:3003 (J;US)
Development of thermal-resistant catalysts, 15:2795 (R;JP)
High-order multiphoton ionization photoelectron spectroscopy of NO, 15:3903 (J;US)

NITRO COMPOUNDS
Burning rates of two cast nitramine explosives using a hybrid closed bomb-strand burner, 15:3382 (R;US)
Fast transit gas- and condensed-phase chemistry of energetic materials, 15:3381 (R;US)

NITROGEN
Monitoring of air pollution in the southern counties, 15:3478 (R;SE;In Swedish)
Use of a charge-coupled device camera for broadband coherent anti-Stokes Raman scattering measurements, 15:3377 (J;US)

NITROGEN 14 TARGET
Cross sections and analyzing powers of $^{15}N(p,n)^{15}O$ at 200 MeV and 494 MeV, 15:4079 (R;US)

NITROGEN COMPOUNDS
See also NITRATES
NITROGEN OXIDES
Climate change and its effect on wet-removal processes, 15:3395 (B;US)
[Deposition of atmospheric nitrogen species to forests in North America and Europe]: Foreign trip report, September 24–October 11, 1989, 15:3422 (R;US)

NITROGEN DIOXIDE
Maintain and operate California Air Resources Board field fumigation facility for experimental use. Final report, 17 December 1987-30 June 1989, 15:3435 (R;US)

NITROGEN MUSTARD
Attempted use of zinc in vivo to protect against nitrogen mustard toxicity in tumor-free and in L1210 leukemia-bearing $B6D2F_1$ mice, 15:3764 (R;US)

NITROGEN NITRIDES
See NITROGEN

NITROGEN OXIDES
See also NITRIC OXIDE
NITROGEN DIOXIDE
Combined NO_x/SO_2 control technology, 15:2421 (R;US)
Emission of nitrogen oxide from a circulating fluidized bed boiler - the influence of design parameters, 15:3466 (R;SE)
Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 7, December 1, 1988–February 28, 1989, 15:2422 (R;US)
NO_X emissions from stationary sources in eastern Europe, 15:3421 (R;NO)

NITROGEN SULFIDES
See SULFUR NITRIDES

NITROSAMINES
Biological (molecular and cellular) markers of toxicity: Semi-annual technical progress report (No. 2), April 1, 1989–September 30, 1989, 15:3765 (R;US)
Comparison of the production and phenotypic properties of altered hepatocyte foci in rats initiated with diethylnitrosamine neonatally or after partial hepatectomy in early adulthood, 15:3599 (R;US)

NMR
See NUCLEAR MAGNETIC RESONANCE

NMR IMAGING
Design and test of a MR-imager with superconducting magnet. Final report, 15:3624 (R;DE;In German)

NMR SPECTRA
Cholesteric lyomesophases based on sodium N-lauroyl asparte: characterization of new system by nuclear magnetic resonance and polarizing microscopy, 15:3076 (R;BR;In Portuguese)
Study of α-monosubstituted methyl acetates by C-13 and H-1 Nuclear Magnetic resonance, 15:4221 (R;BR;In Portuguese)

NMR SPECTROMETERS
Double rotor for solid-state NMR, 15:3375 (J;US)

NON-INDUCTIVE CURRENT DRIVE
Comment on ICRF current drive in reactor grade tokamak, 15:4332 (RA;JP)
Coupling analysis and experiment on fast wave antenna and multijunction grill for current drive, 15:4325 (RA;JP)
Current drive at General Atomics, 15:4328 (RA;JP)
ECRH current drive in the presence of high energy electrons, 15:4329 (RA;JP)
Effect of electron spatial diffusion on current drive, 15:4334 (RA;JP)
Electron cyclotron current drive experiments on WT-3, 15:4330 (RA;JP)
Particle simulation on high power ECH current drive, 15:4338 (RA;JP)

NON-PROLIFERATION TREATY
United States policy on negative security assurances: A reassessment, 15:2803 (R;US)

NONAXIAL NUCLEI
See DEFORMED NUCLEI

NONDESTRUCTIVE TESTING
NDE (non-destructive evaluation) publications, 1985, 15:3217 (R;US)
Neutron-radiography system for field use. Final report, 15:3212 (R;US)
Radiological protection. Responsibility of the Safety Engineering Company, 15:4188 (R;BR;In Portuguese)

NONLINEAR OPTICS
A new nonlinear-optical perturbation expansion and diagrammatic approach, 15:3900 (J;US)
Laser physics and laser techniques. Final report, 15:3154 (R;US)

NONLINEAR PLASMA INSTABILITIES
See PARAMETRIC INSTABILITIES

NONLINEAR PROBLEMS
A basic theorem of complementarity for the generalized variational-like inequality problem: Technical report, 15:4529 (R;US)
Generalized quasi-variational inequality and implicit complementarity problems, 15:4528 (R;US)
Parallel mathematical software: Technical progress report, September 16, 1988–February 14, 1990, 15:4513 (R;US)

NONLINEAR PROGRAMMING
On the identification of local minimizers in inertia-controlling methods for quadratic programming, 15:4546 (R;US)
Sequential quadratic programming algorithms for optimization, 15:4545 (R;US)

NONLINEAR SYSTEMS
See NONLINEAR PROBLEMS

NONRADIOACTIVE WASTE DISPOSAL
See WASTE DISPOSAL

NORTH ATLANTIC REGION
See FEDERAL REGION I

NORTH CAROLINA
Effects of wind and Gulf Stream events on the currents off the coast of North Carolina as it relates to oil-spill risk potential, 15:2128 (R;US)

NORTHERN HEMISPHERE
The effect of urban warming on the Northern Hemisphere temperature average, 15:3397 (J;US)

NORTHERN IRELAND
See UNITED KINGDOM

NOVA FACILITY
Recent experiments with the Nova laser, 15:4480 (J;US)

NOVAE
Hydrodynamic studies of oxygen, neon, and magnesium novae, 15:3875 (BA;US)

NRTS
See IDAHO NATIONAL ENGINEERING LABORATORY

NRTS-ETR REACTOR
See ETR REACTOR

NUCLEAR ACCIDENTS
See ACCIDENTS

NUCLEAR ATTACKS
See NUCLEAR WEAPONS

NUCLEAR CONTESTATION
See PUBLIC RELATIONS

NUCLEAR CONTROVERSY
See HUMAN POPULATIONS

NUCLEAR DATA COLLECTIONS
Annual progress report on nuclear data 1987, 15:4193 (R;FR)
Data for decay Heat Predictions Proceedings of a specialists' meeting, 15:4121 (R;FR)

NUCLEAR ENERGY
Brazilian nuclear policy with respect to the public opinion, 15:2614 (R;BR;In Portuguese)

NUCLEAR EXPLOSIONS
Analysis of fallout prediction codes including the Fallout Assessment system (FAS). Master's thesis, 15:3383 (R;US)
Analysis of forest-fire smoke using satellite imagery. Master's thesis, 15:3384 (R;US)
Assessment of global atmospheric effects of a major nuclear conflict. Final report, 1 February 1984-31 May 1987, 15:3474 (R;US)
Dynamically compressed metals - theory. Final report, 1 February 1986-30 April 1989, 15:4200 (R;US)
Engineering Assignment 5, E-4B surveillance methodology. Final report, 15:3386 (R;US)
Modeling casualties in nuclear warfare. Final report, 15:3385 (R;US)
More about breathing on the Mesa, 15:3516 (R;US)
Strontium-90 in Canada goose eggshells: Non-fatal monitoring for contamination in wildlife, 15:3515 (R;US)

NUCLEAR FACILITIES
See also FUEL FABRICATION PLANTS
FUEL REPROCESSING PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
Demonstration of a computer model for residual radioactive material guidelines, RESRAD, 15:2183 (R;US)
Environmental protection and safety of nuclear facilities, 15:2529 (R;BR;In Portuguese)
Internal progress report of operational environmental monitoring in the region of Pocos de Caldas, MG, Brazil, 15:2487 (R;BR;In Portuguese)
Licesing of mining and milling facilities of uranium and/or thorium ores, 15:2248 (R;BR;In Portuguese)
Radiological survey of the Mare Island Naval Shipyard, Alameda Naval Air Station, and Hunters Point Shipyard, 15:3568 (R;US)
Results of the independent verification of radiological remedial action at 196 East 3rd South Street, Monticello, Utah (MS00083), 15:3513 (R;US)
Results of the independent verification of radiological remedial action at 381 East 3rd South Street, Monticello, Utah (MS00140), 15:3511 (R;US)
Results of the independent verification of radiological remedial action at 384 South 2nd East Street, Monticello, Utah (MS00084), 15:3514 (R;US)
Results of the independent verification of radiological remedial action at 98 East 5th South Street, Monticello, Utah (MS00076), 15:3512 (R;US)
Results of the radiological survey at 9 Hancock Street, Lodi, New Jersey (LJ028), 15:3508 (R;US)

NUCLEAR FRAGMENTATION
Theoretical issues in the search for the quark gluon plasma, 15:4162 (R;US)

NUCLEAR FUEL ELEMENTS
See FUEL ELEMENTS

NUCLEAR FUELS
See also MIXED CARBIDE FUELS
SPENT FUELS
Evaluation of the utilization of neutron activation analysis for measuring non-irradiated nuclear fuels for safeguards, 15:2167 (R;BR;In Portuguese)
Fuel Chemistry Division annual progress report for 1986, 15:2163 (R;IN)
Neutron radiography of the irradiated nuclear fuels, 15:2477 (RA;JP;In Japanese)

NUCLEAR MAGNETIC RESONANCE
Nuclear magnetic resonance in molten salts, 15:4202 (R;US)
Nuclear spin relaxation of ^{12}B implanted in various metallic single crystals, 15:4228 (RA;DE;In German)

NUCLEAR MATTER
Looking for precursors of neutron matter exotica, 15:4161 (R;US)
Single-particle spectrum and ring-diagram nuclear matter calculations: A reply to a Comment, 15:4174 (J;US)
Variational theory of nuclear and neutron matter, 15:4124 (R;US)

NUCLEAR PHYSICS
Max-Planck-Institute for Nuclear Physics. Annual report 1987, 15:4065 (R;DE;In German)
Workshop for cascade project, physics using large acceptance spectrograph and its technical considerations, 15:4069 (R;JP;In Japanese)

NUCLEAR POWER
Agreement between the USSR State Committee on the Use of Nuclear Power and the Department of Energy of the USA regarding joint studies in the field of controlled thermonuclear fusion and plasma physics, 15:4403 (TG;US)

NUCLEAR POWER PLANTS
Closeout of IE Bulletin 86-02: Static "O" ring differential pressure switches, 15:2545 (R;US)
Environmental radionuclide concentrations in the vicinity of the peach bottom atomic power station: 1985-1986. Data report, 15:2456 (R;US)
Evaluation of check valve monitoring methods, 15:2479 (R;US)
Human Factors Regulatory Research Program Plan, FY 1989–FY 1992: Volume 1, 15:2537 (R;US)
Loss-of-coolant accident (LOCA) testing of aged cables for nuclear plant life extension, 15:2476 (R;US)
Lower-bound magnitude for probabilistic seismic hazard assessment: Final report, 15:2526 (R;US)
NRC Regulatory Agenda: Quarterly report, July–September 1989, 15:2468 (R;US)
Nuclear power plant decommissioning. January 1972-September 1989 (Citations from the NTIS data base). Report for January 1972-September 1989, 15:2469 (R;US)
Population dose commitments due to radioactive releases from nuclear power plant sites in 1986, 15:2539 (R;US)
Power reactor embrittlement data base, 15:2510 (R;US)
Probabilistic risk assessment in the nuclear power industry, 15:2616 (B;US)
Programs of meteorology in support of nuclear power plants, 15:3475 (R;BR;In Portuguese)
Prolgraf-B: A knowledge-based system for the automated construction of nuclear plant diagnostic models, 15:2484 (BA;US)
Radiation-related impacts for nuclear plant physical modifications: Final report, 15:2543 (R;US)
Reactor Safety Assessment System, 15:2482 (BA;US)
Where to from here? Future applications of mental models of complex performance, 15:2480 (R;US)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR REACTIONS
See also COMPOUND-NUCLEUS REACTIONS
FISSION
NUCLEAR FRAGMENTATION
PRECOMPOUND-NUCLEUS EMISSION
THERMONUCLEAR REACTIONS
Meteorite tracking network, 15:4151 (RA;DE;In German)
On a class of integrals appearing in the theory of statistical nuclear reactions, 15:4147 (RA;DE)

NUCLEAR SAFETY
See RADIATION PROTECTION

NUCLEAR SHIPS
Radiological surveys of Naval facilities on Puget Sound. Final report, 15:3571 (R;US)

NUCLEAR SPIN RESONANCE
See NUCLEAR MAGNETIC RESONANCE

NUCLEAR STRUCTURE
(n,p) reactions and the nuclear structures, 15:4087 (RA;JP)
Aspects of chaos in nuclear physics, 15:4140 (RA;DE)
Electromagnetic decay of hot rotating nuclei, 15:4150 (RA;DE)

Nuclear structure studies at intermediate energies: Interim progress report, 1988–89: September 1988–August 1989, 15:4064 (R;US)
Positive energy bound states, 15:4132 (R;XA)

NUCLEAR THEORY
[Nuclear theory]: Annual progress report, 15:4128 (R;US)

NUCLEAR WASTES
See RADIOACTIVE WASTES

NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS

NUCLEAR WEAPONS
Announced United States nuclear tests, July 1945–December 1988, 15:3388 (R;US)
Battlefield nuclear weapons and tactical gridlock in Europe, 15:3387 (R;US)
Can the U.S. economy survive a few nuclear weapons, 15:2804 (J;US)
Volunteering for emergency preparedness. Final report, March 1988-March 1989, 15:4550 (R;US)

NUCLEAR WINTER
Analysis of forest-fire smoke using satellite imagery. Master's thesis, 15:3384 (R;US)
Assessment of global atmospheric effects of a major nuclear conflict. Final report, 1 February 1984-31 May 1987, 15:3474 (R;US)
Impact of a simulated nuclear winter environment on growth development and productivity of potatoes, winter wheat, pines and soybeans, 15:3489 (R;US)

NUCLEI
See also DEFORMED NUCLEI
HYPERNUCLEI
INTERMEDIATE MASS NUCLEI
LIGHT NUCLEI
Space-time symmetries in nuclei, 15:4127 (R;US)
Testing string dynamics in lepton nucleus reactions, 15:4067 (R;US)

NUCLEI (CELLS)
See CELL NUCLEI

NUCLEIC ACIDS
See also DNA
OLIGONUCLEOTIDES
Interaction of ruthenium complexes with nucleic acids. DNA damage via sensitized radical production, 15:3733 (RA;DE)

NUCLEON-ANTINUCLEON INTERACTIONS
See also NEUTRON-ANTINEUTRON INTERACTIONS
PROTON-ANTIPROTON INTERACTIONS
How does one see QCD degrees of freedom in physics of interacting hadrons?, 15:4000 (RA;DE;In German)
Nanti N-interaction, 15:4001 (RA;DE;In German)

NUCLEONS
See also NEUTRONS
PROTONS
Neutral pion photoproduction of the nucleon near threshold, 15:3977 (R;US)

NUCLEOTIDE DEHYDROGENASES
Sequence and nitrate regulation of the Arabidopsis thaliana mRNA encoding nitrate reductase, a metalloflavoprotein with three functional domains, 15:3607 (J;US)

NUCLIDES
See ISOTOPES

O

OAK RIDGE NATIONAL LABORATORY
See ORNL

OAK RIDGE RESEARCH REACTOR
See ORR REACTOR

OCCUPANTS
Investigation of the indoor air quality of renovated houses in Bois-le-Duc, Netherlands, 15:2704 (R;NL;In (In Dutch))
Measuring heat flows in collective heating systems. Illusion or reality, 15:2702 (R;NL;In (In Dutch))

OCCUPATIONAL DISEASES
Asbestos and silicate pollution in the work place. January 1978-July 1989 (Citations from Pollution Abstracts). Report for January 1978-July 1989, 15:3461 (R;US)

OCCUPATIONAL EXPOSURE
Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)
Health-hazard evaluation report HETA 87-109-1950, North Riverside Fire Department, North Riverside, Illinois, 15:3458 (R;US)
Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados, 15:3459 (R;US)
In-depth industrial-hygiene survey report on styrene exposure at Larson Industries, Incorporated Boat Plant, Little Falls, Minnesota, February 27-March 1, 1979, 15:3434 (R;US)
National Institute for Occupational Safety and Health (NIOSH): Health Hazard Evaluation Reports. January 1987-September 1989 (Citations from the NTIS data base). Report for January 1987-September 1989, 15:3685 (R;US)
Registry of Toxic Effects of Chemical Substances (RTECS), 1988 computer tape. Data file, 15:3790 (R;US)
Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey, 15:3456 (R;US)
The Hanford Environmental Dose Reconstruction Project: Overview, 15:3749 (R;US)

OCCUPATIONAL SAFETY
National Institute for Occupational Safety and Health (NIOSH): Health Hazard Evaluation Reports. January 1987-September 1989 (Citations from the NTIS data base). Report for January 1987-September 1989, 15:3685 (R;US)
Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication, 15:3684 (R;US)

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
See US OSHA

OCEAN THERMAL POWER PLANTS
Integration and optimization of the gas removal system for hybrid-cycle otec power plants, 15:2330 (BA;US)
Operational experience of the OC-OTEC experiments at NELH, 15:2331 (BA;US)

OFFICE BUILDINGS
Evaluation of the energy conservation program for the NMB bank offices, 15:2677 (R;NL;In (In Dutch))
Evaluation of the energy conservation program for the NMB bank offices. Appendices and figures, 15:2678 (R;NL;In (In Dutch))

OFFSHORE DRILLING
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices, 15:2131 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2, 15:2130 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 1. Final executive summary, 15:2129 (R;US)

OFFSHORE PLATFORMS
Applications of structural systems reliability theory in offshore engineering. State-of-the-art, 15:3255 (R;DK)

OIL POLLUTION CONTAINMENT
Oil-spill removal techniques and equipment. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989, 15:2133 (R;US)

OIL SAND OILS
See BITUMENS

OIL SANDS
Development of a reservoir simulation for thermal recovery of heavy oils/tar sands in the presence of gas hydrates: Final report, 15:2156 (R;US)

OIL SHALE PROCESSING PLANTS
Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan quarterly report, first quarter, 1989. Report for 1 January 1989-31 March 1989, 15:2158 (R;US)

Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan supplemental environmental data report. Volume 1. Trial trip sampling results. Report for 1 January 1988-31 March 1989, 15:2159 (R;US)
Unocal Parachute Creek shale-oil Program. Environmental Monitoring Plan quarterly report, fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2157 (R;US)

OIL SHALE WASTE WATER
See OIL SHALES
WASTE WATER

OIL SHALES
Beneficiation-hydroretort processing of US oil shales, Volume 1: Final report, 15:2155 (R;US)

OIL SPILL FINGERPRINTING
See OIL SPILLS

OIL SPILLS
Effects of wind and Gulf Stream events on the currents off the coast of North Carolina as it relates to oil-spill risk potential, 15:2128 (R;US)
Oil-spill removal techniques and equipment. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989, 15:2133 (R;US)
Removal of oil from oil-water mixtures using selective oil filtration. Masters thesis, 15:2132 (R;US)

OIL WELLS
Altered-stress fracturing, 15:2117 (J;US)
Predicting horizontal/slanted well production by mathematical modeling, 15:2115 (BA;US)

OILS
See also LUBRICATING OILS
WASTE OILS
Removal of oil from oil-water mixtures using selective oil filtration. Masters thesis, 15:2132 (R;US)

OLEFINS
See ALKENES

OLIGONUCLEOTIDES
Free radicals formed by electron gain in oligomers of DNA, 15:3702 (RA;DE)

OMEGA FACILITY
Broadband phase conversion of the frequency tripled Omega laser, 15:4370 (BA;US)

OMEGA-783 MESONS
Role of mesonic resonances in antiproton annihilation on nuclei, 15:4173 (J;US)
Study of $\omega\omega$ systems produced in 38 GeV/c $\pi^- p$ collisions, 15:3969 (J;US)

OMEGA-784 RESONANCES
See OMEGA-783 MESONS

ON-LINE COMPUTERS
See COMPUTERS

ON-SITE POWER GENERATION
Utilization of computerized control for optimization of energy systems, 15:2762 (R;DK;In Danish)

OPERATION (REACTOR)
See REACTOR OPERATION

OPERATORS (MATHEMATICAL)
See MATHEMATICAL OPERATORS

OPTICAL EQUIPMENT
In situ optical measurements of hydrofluoric acid aerosols, 15:3469 (R;US)
Optical instrumentation support for the airborne ionospheric observatory. Report for 1 July 1987-30 June 1988, 15:3884 (R;US)

OPTICAL MODELS
Coulomb-nuclear interference in elastic heavy-ion scattering, 15:4166 (J;NL)

OPTICAL SPECTROMETERS
A simple implementation of a power supply for constant phototube current in light modulation spectroscopy, 15:3376 (J;US)

OPTICAL SYSTEMS
Development of Fusion and Plasma Diagnostics Center - synchrotron radiation experiment, (2). Characterization of primary monochromator and construction of calibration apparatus and its application, 15:4318 (R;JP;In Japanese)

ORE PROCESSING
Licesing of mining and milling facilities of uranium and/or thorium ores, 15:2248 (R;BR;In Portuguese)

ORGANIC COMPOUNDS
See also ALDEHYDES
AROMATICS
HYDROCARBONS
NUCLEIC ACIDS
ORGANIC HALOGEN COMPOUNDS
ORGANIC NITROGEN COMPOUNDS
ORGANIC PHOSPHORUS COMPOUNDS
ORGANIC POLYMERS
OTHER ORGANIC COMPOUNDS
PROTEINS
Accumulation patterns of heavy metals and chlorinated hydrocarbons by sea otters, Enhydra lutris, in California. Final report, 15:3788 (R;US)
Comparison of 0600-0900 AM hydrocarbon compositions obtained from 29 cities, 15:3431 (R;US)
Destruction of volatile organic compounds using catalytic oxidation. Report for April 1987-December 1988, 15:3439 (R;US)
Estimating human-equivalent no observed adverse-effect levels for VOCs (volatile organic compounds) based on minimal knowledge of physiological parameters. Technical paper, 15:3783 (R;US)
Steam stripping and batch distillation for the removal/recovery of volatile organic compounds, 15:2736 (R;US)
Superfund Record of Decision (EPA Region 5): Wausau Water Supply, WI. (First Remedial Action), December 1988, 15:3587 (R;US)
Thiourea derivatives: Process for their production and for their use for neutron capture therapy of malignant melanomas, 15:3618 (TG;US)
Use of micrometeorological parameters in the establishment of a VOC (volatile organic compounds) monitoring network. Technical report (Final), 15:3454 (R;US)
Validation and application of pharmacokinetic models for interspecies extrapolations in toxicity risk assessments of volatile organics. Annual report No. 2, 1 July 1988-30 June 1989, 15:3757 (R;US)

ORGANIC FLUORINE COMPOUNDS
See also FLUORINATED ALIPHATIC HYDROCARBONS
Column flotation of coal with fluorosurfactants: Final report, 15:2014 (R;US)
Electronic materials high-T_c superconductivity polymers and composites structural materials surface science and catalysts industry participation: Annual report, 1988, 15:2923 (R;US)

ORGANIC HALOGEN COMPOUNDS
See also HALOGENATED ALIPHATIC HYDROCARBONS
ORGANIC FLUORINE COMPOUNDS
Formation and control of non-trihalomethane by-products, 15:3556 (R;US)
New chemical alternatives to chlorofluorocarbons and halons. Report for August 1988-February 1989, 15:3436 (R;US)

ORGANIC NITROGEN COMPOUNDS
See also AMIDES
NITRO COMPOUNDS
PORPHYRINS
Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)

ORGANIC PHOSPHORUS COMPOUNDS
Best demonstrated available technology (BDAT) background document for organophosphorous wastes, 15:2766 (R;US)

ORGANIC POLYMERS
See also COPOLYMERS
POLYAMIDES
POLYETHYLENE GLYCOLS
POLYOLEFINS
RESINS
Waste-minimization insights for the polymer industry, 15:2742 (R;US)

ORGANIC SOLVENTS
Reduction of solvent wastes in the electronics industry. Waste reduction grant program. Final report, 15:2749 (R;US)
Ultrasonic and immersion cleaning: a comparison using aqueous and fluorocarbon solvents, 15:2176 (R;GB)
ORNL
ORNL [Oak Ridge National Laboratory] 89, 15:2610 (R;US)
[Ecosystem research on Walker Branch watershed]: Foreign trip report, October 22–28, 1989, 15:3499 (R;US)
ORNL RESEARCH REACTOR
See ORR REACTOR
ORR REACTOR
Interpretation of gamma-scanning data from the ORR demonstration elements, 15:2489 (R;US)
OSCILLATIONS (PLASMA)
See PLASMA WAVES
OSCILLATORS
See also HARMONIC OSCILLATORS
Effect of mode competition on the efficiency of FEL oscillators in the low gain regime, 15:3169 (BA;US)
OSHA
See US OSHA
OSMIUM
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 2, 15:2262 (R;US)
OSMOSIS
Membrane gas separation. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3065 (R;US)
OTHER ORGANIC COMPOUNDS
See also OILS
Effects of environmental variables on fatigue crack growth rate in steel immersed in seawater, 15:2826 (R;JP)
OUTER CONTINENTAL SHELF
See CONTINENTAL SHELF
OUTPUT
See PRODUCTION
OVERVOLTAGE
Lightning, surge, and transient protection. December 1982-September 1989 (Citations from the NTIS data base). Report for December 1982-September 1989, 15:2433 (R;US)
OXIDASES
See OXIDOREDUCTASES
OXIDES
See also ALUMINIUM OXIDES
BARIUM OXIDES
BISMUTH OXIDES
CALCIUM OXIDES
CHROMIUM OXIDES
COPPER OXIDES
INDIUM OXIDES
IRON OXIDES
LANTHANUM OXIDES
LEAD OXIDES
LITHIUM OXIDES
MAGNESIUM OXIDES
NIOBIUM OXIDES
NITROGEN OXIDES
POTASSIUM OXIDES
PRASEODYMIUM OXIDES
RHENIUM OXIDES
SILICON OXIDES
STRONTIUM OXIDES
SULFUR OXIDES
THALLIUM OXIDES
THORIUM OXIDES
TITANIUM OXIDES
URANIUM OXIDES
YTTRIUM OXIDES
ZINC OXIDES
ZIRCONIUM OXIDES
Acoustic studies of new materials: Quasi crystals, low-loss glasses, and high tc superconductors. Annual summary report, 1 October 1988-30 September 1989, 15:2901 (R;US)
Glancing angle x-ray studies of oxide films: Revision, 15:2903 (R;US)
OXIDOREDUCTASES
See also NUCLEOTIDE DEHYDROGENASES
Sequence and nitrate regulation of the Arabidopsis thaliana mRNA encoding nitrate reductase, a metalloflavoprotein with three functional domains, 15:3607 (J;US)
OXIRANS
See EPOXIDES
OXONIUM IONS
Participation in the MAP3S precipitation chemistry network: Progress report, August 1, 1988–July 31, 1989, 15:3410 (R;US)
OXYGEN
Anisotropy of oxygen tracer diffusion in $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:2914 (R;US)
Band bending and oxygen-induced defects in *a*-Si:H, 15:3007 (J;US)
Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)
OXYGEN 16 REACTIONS
Boltzmann-Uehling-Uhlenbeck and relaxation time methods: A comparison, 15:4171 (J;US)
High energetic photons from heavy ion collisions, 15:4105 (RA;DE;In German)
Preequilibrium emission of neutrons in central heavy-ion collisions at 15-20 MeV/A bombarding energy, 15:4086 (RA;DE;In German)
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)
OXYGEN 16 TARGET
Boltzmann-Uehling-Uhlenbeck and relaxation time methods: A comparison, 15:4171 (J;US)
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)
OXYGEN 17
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)
OXYGEN 18 REACTIONS
Heavy ion induced transfer reactions with ^{232}Th by the Crystal Ball, 15:4115 (RA;DE;In German)
Systematics of the (^{18}O,^{20}Ne) reaction and the determination of the mass excess of ^{122}Cd, 15:4093 (RA;DE;In German)
OXYGEN 18 TARGET
Thick-target ^{21}Ne yield of the reaction $^{18}O(\alpha,n)^{21}Ne$ in the range 4.0-8.8 MeV, 15:4078 (RA;DE;In German)
OXYGEN EFFECT (RADIOBIOLOGY)
See OXYGEN
OXYGEN HYDRIDES
See WATER
OXYGEN IONS
A review of radiative and dielectronic recombination for C and O ions, 15:3899 (J;SE)
OXYMETHYLENE
See FORMALDEHYDE
OZONE
Are ozone exceedance rates decreasing? Comment on extreme value analysis of environmental time-series: An application to trend detection in ground-level ozone. Technical report, 1 January-31 July 1989, 15:3401 (R;US)
Chronic exposure to ozone causes restrictive lung disease, 15:3781 (R;US)
Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)
Effects of air pollutants on photosynthesis, vegetative growth, and development of grapevines in the San Joaquin Valley of California. Final report, February 1987-February 1989, 15:3445 (R;US)
Maintain and operate California Air Resources Board field fumigation facility for experimental use. Final report, 17 December 1987-30 June 1989, 15:3435 (R;US)
Ozone and other issues in global atmospheric chemistry, 15:3394 (B;US)
Red spruce decline—Winter injury and air pollutants, 15:3427 (R;US)

Sensitivity of a regional oxidant model to variations in climate parameters. Volume 1 and 2. Final report, 15:3453 (R;US)

OZONE LAYER
International aspects of restrictions of ozone-depleting substances, 15:3462 (R;US)
New chemical alternatives to chlorofluorocarbons and halons. Report for August 1988-February 1989, 15:3436 (R;US)
Ozone depletion, greenhouse gases, and climate change, 15:3429 (R;US)

1,3,5-TRIAMINO-2,4,6-TRINITROBENZENE
See TATB

P

P-TYPE CONDUCTORS
Nonlinear absorption of CO_2 laser radiation in *p*-type InSb, 15:3177 (J;US)

PACEMAKERS
See CARDIAC PACEMAKERS

PACIFIC NORTHWEST REGION
See FEDERAL REGION X

PACIFIC OCEAN
See also PUGET SOUND
The Pacific Basin Consortium: A new device for problems without borders, 15:3496 (R;US)

PACKAGING
Toxicity: Polymeric materials in food-contact applications. January 1977-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1977-September 1989, 15:3789 (R;US)

PACKED BED
Heat transfer, 15:2805 (B;US)

PAINTS
Effects of acid deposition on painted wood substrates, 15:3432 (R;US)
Walk-through survey report: Northeast Utilities Service Co./Stone and Webster Engineering Corp., Millstone Plant No. 3, Waterford, Connecticut, August 29, 1979, 15:3770 (R;US)
Waste audit study: Automotive paint shops, 15:2744 (R;US)

PALLADIUM
A single turnover (STO) characterization of supported palladium catalysts, 15:3082 (BA;US)
Calorimetric measurements on electrochemical cells with Pd-D cathodes, 15:2575 (R;US)
Characterization of nanophase materials by x-ray diffraction and computer simulation, 15:4206 (R;US)
In-situ ion beam measurements of deuterium loading in thin foil electrochemical cells, 15:2853 (R;US)
Thermally and ion-induced phase formation in a Pd/Ge bilayer, 15:2882 (J;US)
Thermodynamic properties of fcc transition metals as calculated with the embedded-atom method, 15:2883 (J;US)

PALLADIUM BASE ALLOYS
Phase properties of the rapid cooled palladium-silicon alloy in the concentration range 40 to 58 at.% Si, 15:2851 (R;JP)

PALLADIUM COMPLEXES
Transition metal catalyzed transformations of unsaturated molecules, 15:3074 (R;US)

PALLADIUM COMPOUNDS
Molecular-dynamics investigation of deuteron separation in $PdD_{1.1}$, 15:2963 (J;US)

PAPER INDUSTRY
Pulping effluents: Biological treatment. January 1976-September 1989 (Citations from the Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989, 15:2752 (R;US)
Wastepaper recycling. January 1976-September 1989 (Citations from the Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989, 15:2751 (R;US)

PARACHUTES
An experimental investigation of wall-interference effects for parachutes in closed wind tunnels, 15:3139 (R;US)

PARAFFINS
See ALKANES

PARALLEL PROCESSING
Computational and statistical issues in discrete-event simulation. Technical report, 15:4502 (R;US)
Implementation indices (1975-1979). Volume 1. Technical report, 15:4497 (R;US)
Optimization algorithms for new computer architectures with applications to personnel-assignment models. Annual report (Final), 1 May 1988-30 April 1989, 15:4501 (R;US)
PCP [Parallel C Preprocessor]: A parallel extension of C that is 99% fat free: Revision 1, 15:4531 (R;US)
Parallel processing and learning in simple systems. Final report, 10 January 1986-14 January 1989, 15:3595 (R;US)
Research, development, training, and education using the Ada programming language. Final report, 1 September 1987-31 May 1989, 15:4503 (R;US)
Rewrite Rule Machine project. Final report, 15:4500 (R;US)
Strand: A practical parallel programming language, 15:4512 (R;US)

PARAMAGNETIC RESONANCE (NUCLEAR)
See NUCLEAR MAGNETIC RESONANCE

PARAMETRIC INSTABILITIES
Parametric instabilities of Langmuir waves in weak/moderate magnetic fields, 15:4377 (J;US)

PARASYMPATHOLYTICS
New techniques for positron emission tomography in the study of human neurological disorders: Progress report, June 15, 1987–November 15, 1989, 15:3616 (R;US)

PARKS (INDUSTRIAL)
See INDUSTRIAL PARKS

PARTIAL DIFFERENTIAL EQUATIONS
See also EQUATIONS OF MOTION
HAMILTON-JACOBI EQUATIONS
MAXWELL EQUATIONS
Parallel mathematical software: Technical progress report, September 16, 1988–February 14, 1990, 15:4513 (R;US)
Self similar solutions of the second kind of nonlinear diffusion-type equations, 15:4273 (R;XA)
Solvability in $D^{1,2}(\Omega)$ of the equation $-\Delta u+c=Ke^{u}$, 15:4268 (R;XA)
The parallel performance of Schwarz splitting, 15:4508 (R;US)

PARTICLE BEAM FUSION ACCELERATOR
Crossed-field amplifiers as RF drivers for particle beam accelerators, 15:4455 (BA;US)
Lithium beam measurements on PBFA II, 15:3311 (BA;US)

PARTICLE BEAMS
Applications of RF linacs to free-electron lasers and particle beams, 15:3312 (J;US)
Applications of induction linacs to free-electron lasers and particle beams, 15:3313 (J;US)
Classification of beam breakup instabilities in linear accelerators, 15:3282 (J;US)

PARTICLE INTERACTIONS
See also HADRON-HADRON INTERACTIONS
PHOTON-PHOTON INTERACTIONS
QUARK-GLUON INTERACTIONS
Theoretical aspect of J/PSI production in nucleus-nucleus collisions, 15:3976 (R;FR)

PARTICLE PRODUCTION
See also MULTIPLE PRODUCTION
Intermittency in multiparticle dynamics, 15:3981 (R;US)
Search for characteristic times governing the emission of two particles from an excited nucleus, 15:4063 (R;FR)

PARTICLES
See also DROPLETS
PARTICULATES
Development of a data-processing model for steady turbulent 3-D gas particle flow, 15:3110 (R;DK;In Danish, English)

PARTICULATES
Characterization and modification of particulate properties to enhance filtration performance: Quarterly technical progress report, December 1988–February 1989, 15:2423 (R;US)

Compliance testing of the Eglin AFB (Air Force Base) asphalt-concrete Batch Plant, Eglin AFB, Florida. Final report, 5-11 March 1989, 15:3403 (R;US)
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)
Measurement of condensable vapor contribution to PM10 emissions, 15:2696 (R;US)
Mutagenicity of combustion emissions from a biomedical-waste incinerator, 15:3774 (R;US)
Pilot investigation of indoor-outdoor and personal PM10 (thoracic) and associated ionic compounds and mutagenic activity. Final report, February 1987-April 1989, 15:3447 (R;US)
Quantitative evaluation of air-filtration systems in use at asbestos abatement sites: Research in progress, 15:3256 (R;US)

PARTITION FUNCTIONS
Thirring model on a Riemann surface, 15:4048 (J;US)

PASSENGERS
See OCCUPANTS

PASSIVE SOLAR HEATING SYSTEMS
Experimental and theoretical investigation of passive use of solar energy on house facades, 15:2676 (R;DE;In German)

PATHOLOGICAL CHANGES
See also HEMORRHAGE
Computerized tomography in diagnosis of dystrophic vertebrae lesions, 15:3628 (RA;SU;In Russian)

PAVEMENTS
Applicability of the DMSO (dimethyl sulfoxide) aggregate degradation test to determine moisture-induced distress in asphalt-concrete mixes. Final report, June 1986-June 1987, 15:2980 (R;US)
HRIS (Highway Research Information Service) Abstracts. Volume 21, Number 4 - Winter 1988, 15:2713 (R;US)

PBF REACTOR
Neutronics design of the INEL [Idaho National Engineering Laboratory] facility for boron neutron capture therapy clinical trials, 15:2490 (R;US)

PBFA
See PARTICLE BEAM FUSION ACCELERATOR

PCB
See CHLORINATED AROMATIC HYDROCARBONS

PEAT
Calculation of peat production expenses, 15:2088 (R;FI;In Finnish)
Combustion of fixed-bed in grate firing, 15:3115 (R;FI;In Finnish)
Development of a mesuring method for the efficiency of milled peat production, 15:2089 (R;FI;In Finnish)
Development of a moisture meter for milled layer, 15:2087 (R;FI;In Finnish)
Development of the method for measuring the thickness of a milled peat layer, 15:2090 (R;FI;In Finnish)
Gasification of solid fuels in energy management of industry, 15:2030 (R;FI;In Finnish)
Peat - Environment - Society. Part 2: Emissions from combustion of peat, 15:2073 (R;FI;In Finnish)

PEATLANDS
See WETLANDS

PELLET INJECTION
Acceleration of small, light projectiles (including hydrogen isotopes) to high speeds using a two-stage light gas gun, 15:4396 (R;US)
Upgrade of JT-60 pellet injector for higher velocity, 15:4423 (R;JP;In Japanese)

PENNSYLVANIA
Near-surface neotectonic deformation associated with seismicity in the northeastern United States, 15:3814 (R;US)

PENTAERYTHRITOL TETRANITRATE
See PETN

PEOPLE
See HUMAN POPULATIONS

PEOPLES REPUBLIC OF CHINA
See CHINA

PEPTIDES
Thymaline as a factor of homeostasis correction in the process of radiotherapy, 15:3652 (RA;SU;In Russian)

PERFORMANCE
ISIS: An Interactive System for Instruction and Sampling, 15:3483 (R;US)

PERMEABILITY DAMAGE
See FORMATION DAMAGE

PERMEABILITY REDUCTION
See FORMATION DAMAGE

PERSONNEL
See also ASTRONAUTS
MILITARY PERSONNEL
REACTOR OPERATORS
SECURITY PERSONNEL
A review of the literature on the toxicity of rare-earth metals as it pertains to the Engineering Demonstration System surrogate testing, 15:3792 (R;US)
Model for measuring complex performance in an aviation environment, 15:3127 (R;US)

PERSONNEL MANAGEMENT
Optimization algorithms for new computer architectures with applications to personnel-assignment models. Annual report (Final), 1 May 1988-30 April 1989, 15:4501 (R;US)
The effective supervision seminar the management development seminar: Final project report, 15:4490 (R;US)

PESTICIDES
Best demonstrated available technology (BDAT) background document for K043. Final report, 15:2771 (R;US)
Methods for aquatic toxicity-identification evaluations. Phase 3. Toxicity confirmation procedures. Technical report, 15:3549 (R;US)

PETN
Fast transit gas- and condensed-phase chemistry of energetic materials, 15:3381 (R;US)

PETROCHEMICAL FEEDSTOCKS
See CHEMICAL FEEDSTOCKS

PETROLEUM
An investigation of coal-oil reaction pathways using model compounds, 15:2049 (B;US)
Crude oil emulsions. Abstracts, 15:2108 (R;DE;In German)
Development of a reservoir simulation for thermal recovery of heavy oils/tar sands in the presence of gas hydrates: Final report, 15:2156 (R;US)
Inhibition of retrogressive reactions in coal/petroleum coprocessing: Quarterly technical progress report, June 1, 1989–August 31, 1989, 15:2025 (R;US)
Interaction between thermophilic microorganisms and crude oils: Recent developments, 15:2107 (R;US)
International energy annual, 1988, 15:2630 (R;US)
Lubricated pipelining: Stability of core-annular flow, 15:2134 (R;US)
Petroleum fuels. Development of quality from 1980 and on, 15:2135 (R;SE;In Swedish)
Petroleum marketing monthly, 15:2125 (R;US)
Petroleum supply monthly, August 1989, 15:2628 (R;US)
Process and analytical studies of enhanced low severity coprocessing using selective coal pretreatment: Quarterly technical progress report, June–August, 1989, 15:2022 (R;US)
The influence of texture on steady foam flow in Berea sandstone, 15:2109 (R;US)
The influence of texture on steady foam flow in Berea sandstone, 15:2111 (R;US)
The present-day situation of the mineral oil industry, 15:2126 (RA;DE;In German)
Use of amine oxide surfactants for chemical flooding EOR [enhanced oil recovery], 15:2112 (R;US)

PETROLEUM COKE
See COKE
PETROLEUM PRODUCTS

PETROLEUM DEPOSITS
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 3. Appendices, 15:2131 (R;US)

Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 2, 15:2130 (R;US)
Georges Bank benthic infauna monitoring program. Final report for third year of sampling. Volume 1. Final executive summary, 15:2129 (R;US)

PETROLEUM INDUSTRY
Effects of wind and Gulf Stream events on the currents off the coast of North Carolina as it relates to oil-spill risk potential, 15:2128 (R;US)
Festive colloquium to celebrate the 70th anniversary of Prof. em. o. Dr.-Ing. Friedrich Adler. Berlin, October 17, 1986, 15:2085 (R;DE;In German)
Membrane separation processes for liquid hydrocarbons and gases in the petrochemical industry: A technical case study, 15:2118 (R;US)
The present-day situation of the mineral oil industry, 15:2126 (RA;DE;In German)

PETROLEUM PRODUCTS
See also DIESEL FUELS
LUBRICATING OILS
International energy annual, 1988, 15:2630 (R;US)
Petroleum marketing monthly, 15:2125 (R;US)
Petroleum supply monthly, August 1989, 15:2628 (R;US)
Quarterly oil report: First quarter, 1989, 15:2124 (R;US)

PETROLEUM REFINERIES
Biocrude suitability for petroleum refineries, 15:2269 (R;US)

PETT
See POSITRON COMPUTED TOMOGRAPHY

PHANTOMS
Development of a mathematical phantom for a child with 10 years age for internal dosimetry, 15:4189 (R;BR;In Portuguese)

PHARMACEUTICALS
See DRUGS

PHASE CHANGE MATERIALS
Some heat transfer problems with phase change processes. Numerical and experimental analysis, 15:3191 (R;SE)

PHENYL METHYL ETHER
See ANISOLE

PHENYLETHYLENE
See STYRENE

PHOSPHORUS FLUORIDES
Theory of unusual anisotropy of magnetoresistance in organic superconductors, 15:3011 (J;US)

PHOSPHORUS IONS
Direct and resonance contributions to electron-impact excitation of n=2 to n=3 transitions in neonlike ions, 15:3907 (J;US)

PHOSPHORUS-GROUP TRANSFERASES
Binding of adenosine diphosphoribosyltransferase to the termini and internal regions of linear DNAs (deoxyribonucleic acids), 15:3597 (R;US)

PHOTODIODES
Evaluation of a linear photodiode array detector for synchrotron small-angle x-ray scattering measurements, 15:3231 (J;US)

PHOTOFISSION
(e,e'f) coincidence experiments for fission decay of giant resonances in ^{235,238}U, 15:4113 (RA;DE;In German)

PHOTOGRAPHIC FILMS
Source characterization and control technology assessment of methylene chloride emissions from Eastman Kodak Company, Rochester, NY. Final report, July 1988-April 1989, 15:3452 (R;US)

PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS

PHOTON BEAMS
Flux and power spectra of photon sources from bending magnets and insertion devices at a 8 GeV storage ring, 15:3324 (R;JP)
Hamiltonian chaos in a nonlinear polarized optical beam, 15:4285 (R;US)

PHOTON COLLISIONS
See also PHOTON-ELECTRON COLLISIONS
PHOTON-ION COLLISIONS
International bulletin on atomic and molecular data for fusion. No. 39, 15:4317 (R;XA)

PHOTON TRANSPORT
Radiation-transport calculations of a simple structure using the vehicle code system with 69-group cross sections and the Monte Carlo neutron and photon code. Final report, 15:4178 (R;US)

PHOTON-ELECTRON COLLISIONS
Physics guide to CEPXS: A multigroup coupled electron-photon cross-section generating code: Version 1.0, 15:3894 (R;US)

PHOTON-ION COLLISIONS
Laser-induced electron-ion interaction, 15:3889 (RA;DE;In German)

PHOTON-NUCLEON INTERACTIONS
Neutral pion photoproduction of the nucleon near threshold, 15:3977 (R;US)

PHOTON-PHOTON INTERACTIONS
Pair production from photon-pulse collisions, 15:4016 (J;US)

PHOTONS
Radiative kaon capture at rest in hydrogen, 15:3971 (J;US)

PHOTOSYNTHESIS
Effects of air pollutants on photosynthesis, vegetative growth, and development of grapevines in the San Joaquin Valley of California. Final report, February 1987-February 1989, 15:3445 (R;US)
Transcription of oxygen-regulated photosynthetic genes requires DNA gyrase in Rhodobacter capsulatus, 15:3606 (J;US)

PHOTOTUBES
A simple implementation of a power supply for constant phototube current in light modulation spectroscopy, 15:3376 (J;US)

PHOTOVOLTAIC CELLS
See also SOLAR CELLS
Crystalline silicon photovoltaic cell technology: Meeting the challenge for utility power, 15:2313 (BA;US)
GaSb booster cells for over 30% efficient solar-cell stacks, 15:2319 (J;US)
Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 3 final subcontract report, February 1, 1986–January 31, 1987, 15:2303 (R;US)
Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 2, Semiannual report, February 1, 1988–July 31, 1989, 15:2305 (R;US)

PHOTOVOLTAIC CONVERSION
Photovoltaic energy conversion - research projects on solar energy use, 15:2293 (R;DE;In German)

PHTHALATES
Best demonstrated available technology (BDAT) background document for phthalate wastes, 15:2767 (R;US)

PHTHALOCYANINES
Direct insertion of metal ions into tetrasulfonated phthalocyanine, 15:3071 (R;US)

PIGE ANALYSIS
See PROTON REACTIONS

PIGMENT CELLS
See ANIMAL CELLS

PINES
Carbohydrate translocation and branch autonomy of Pinus ponderosa, 15:2309 (R;US)
Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)

PION MINUS-PROTON INTERACTIONS
Study of $\omega\omega$ systems produced in 38 GeV/c $\pi^- p$ collisions, 15:3969 (J;US)

PION PLUS REACTIONS
Pion induced double-charge exchange above the resonance, 15:4160 (R;US)

PION-NUCLEON INTERACTIONS
Pion distribution in the nucleon, 15:3975 (R;US)

PION-PION INTERACTIONS
Contribution of two-pion annihilation to dilepton emission from proton-nucleon collisions, 15:4008 (J;US)

PIONIC ATOMS
Studies of deeply bound π^- states by (n,p) and (d,^{2}He) pion transfer reactions, 15:4110 (RA;JP)

PIONS
See also PIONS NEUTRAL

Quark-mass dependence of the chiral model parameters, 15:3998 (RA;DE)
Weak decays of K and π mesons, 15:4013 (J;US)

PIONS NEUTRAL
Neutral pion photoproduction of the nucleon near threshold, 15:3977 (R;US)

PIPELINE QUALITY GAS
See HIGH BTU GAS

PIPELINES
Liquefaction hazards and their effects on buried pipelines. Technical report, 15:3254 (R;US)
Lubricated pipelining: Stability of core-annular flow, 15:2134 (R;US)
Statistics of interstate natural gas pipeline companies, 1988, 15:2149 (R;US)

PIPES
Deposition of cobalt on surface-treated stainless steel under PWR conditions, 15:2445 (R;US)
Development of short-term tests for evaluating plastic gas-piping materials. Annual report, January-December 1984, 15:2150 (R;US)
Quality control and requirements for corona heated HDPE casing for district heating pipelines, 15:2779 (R;SE;In Swedish)
Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)
Stability of core-annular flow in a rotating pipe, 15:3941 (J;US)

PLANETARY EVOLUTION
Isotopic and chemical evolution of planets: Mars as a missing link, 15:3829 (RA;US)

PLANNING
Quality-assurance plan for the Basic Environmental Compliance and Monitoring Program (BECAMP), 15:3744 (R;US)

PLANT GROWTH
Effects of acid fog and ozone on conifers. Final report, 15:3446 (R;US)
Effects of air pollutants on photosynthesis, vegetative growth, and development of grapevines in the San Joaquin Valley of California. Final report, February 1987-February 1989, 15:3445 (R;US)

PLANTS
See also FUNGI
TREES
Convention on international trade in endangered species of wild fauna and flora. 1987 annual report. Final report, 15:3613 (R;US)
Impact of a simulated nuclear winter environment on growth development and productivity of potatoes, winter wheat, pines and soybeans, 15:3489 (R;US)
Maintain and operate California Air Resources Board field fumigation facility for experimental use. Final report, 17 December 1987-30 June 1989, 15:3435 (R;US)
Plant senescence: Its biochemistry and physiology, 15:3601 (B;US)

PLANTS (INDUSTRIAL)
See INDUSTRIAL PLANTS

PLANTS (POWER)
See POWER PLANTS

PLASMA
See also AMBIPLASMA
COLD PLASMA
COLLISIONLESS PLASMA
EQUILIBRIUM PLASMA
HIGH-BETA PLASMA
HOT PLASMA
INHOMOGENEOUS PLASMA
LASER-PRODUCED PLASMA
LOW-BETA PLASMA
RELATIVISTIC PLASMA
Current drive via magnetohydrodynamic helicity waves, 15:3940 (J;US)
Excitation of the toroidicity-induced shear Alfven eigenmode by fusion alpha particles in an ignited tokamak, 15:4374 (J;US)
Experimental study of microwave transmission through a decaying plasma. Final report, January 1986-February 1988, 15:3936 (R;US)
Investigation of the non linear Buneman instability in a multi ion plasma, 15:4313 (R;XA)
Ion temperature gradient-driven turbulence in tokamaks with flat density profiles, 15:4376 (J;US)
Ion-sound emission by Langmuir soliton reflected at density barrier, 15:4316 (R;XA)
Parametric instabilities of Langmuir waves in weak/moderate magnetic fields, 15:4377 (J;US)
Quasilinear diffusion modeling of the alpha-loss-cone instability in a tandem-mirror reactor, 15:4381 (J;US)
Second stability in the ATF torsatron, 15:4372 (J;US)
Temperature fluctuations and transport in a tokamak edge plasma, 15:4379 (J;US)
Theory of weak ion temperature gradient-driven turbulence near the threshold of instability, 15:4375 (J;US)
Visible imaging of edge fluctuations in the TFTR tokamak, 15:4383 (J;US)

PLASMA (QUARK)
See QUARK MATTER

PLASMA ACCELERATION
Electrothermal guns – a theoretical investigation of factors for optimal performance. Technical report, 15:2660 (R;US)
Reflection of accelerated plasma rings from conical electrodes in the RACE experiment, 15:4368 (BA;US)

PLASMA ACCELERATORS
See PLASMA GUNS

PLASMA CONFINEMENT
See also INERTIAL CONFINEMENT
Status of the design and construction of the CPRF and the ZTH reversed field pinch experiment, 15:4360 (BA;US)

PLASMA DIAGNOSTICS
Spectroscopic determination of the electrostatic potential profile in a plasma-prefilled ion diode, 15:3230 (J;US)
Visible imaging of edge fluctuations in the TFTR tokamak, 15:4383 (J;US)
X and UV time resolving diagnostics for X-ray laser experiments, 15:4369 (BA;US)

PLASMA DIODES
See THERMIONIC DIODES

PLASMA DISRUPTION
ITER disruption modeling using TSC [Tokamak Simulation Code], 15:4301 (R;US)
Magnetic microtearing coherence in tokamak plasmas, 15:4311 (R;FR;In French)

PLASMA GUNS
Electrothermal guns – a theoretical investigation of factors for optimal performance. Technical report, 15:2660 (R;US)

PLASMA HEATING
Neutral beam injection current drive sensitivity study for the tokamak ignition/burn experimental reactor II, the U.S.: Option for International Thermonuclear Reactor, and the International Tokamak Reactor, 15:4483 (J;US)

PLASMA MACROINSTABILITIES
See also PARAMETRIC INSTABILITIES
Implosion symmetry and stability, 15:4386 (R;FR)

PLASMA OSCILLATIONS
See PLASMA WAVES

PLASMA PRODUCTION
Characteristics of plasma produced by an RF induction discharge, 15:4364 (BA;US)
Study of a plasma edge cathode scheme for electron beam extraction, 15:4365 (BA;US)

PLASMA SCRAPE-OFF LAYER
Practical aspects of a 2-D edge-plasma model, 15:4450 (R;US)

PLASMA SHEATH
Self-consistent radial sheath, 15:4380 (J;US)

PLASMA SIMULATION
2.5D EM direct implicit PIC simulation using AVANTI, 15:4356 (R;US)
Relativistic extension of the electromagnetic direct implicit PIC algorithm, 15:4357 (R;US)

PLASMA SWITCHES
Single fluid simulations of plasma openings switch behavior, 15:3308 (R;US)
PLASMA WAVES
CRRES (Combined Release and Radiation Effects Satellite) SAPCERAD Plasma Wave Experiment. Final report, 20 April 1982-30 June 1988, 15:3883 (R;US)
Phase conjugate reflection of electromagnetic waves from a plasma, 15:4363 (BA;US)
PLASTICS
Plastics and elastomers: Radiation crosslinking. April 1986-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for April 1986-September 1989, 15:2981 (R;US)
PLASTICS INDUSTRY
In-depth industrial-hygiene survey report on styrene exposure at Fiberform, Spokane, Washington, January 16-18, 1979, 15:3433 (R;US)
In-depth industrial-hygiene survey report on styrene exposure at Larson Industries, Incorporated Boat Plant, Little Falls, Minnesota, February 27-March 1, 1979, 15:3434 (R;US)
PLATES (FUEL)
See FUEL PLATES
PLATINUM
Anharmonic damping in rare-gas multilayers, 15:2888 (J;US)
Thermodynamic properties of fcc transition metals as calculated with the embedded-atom method, 15:2883 (J;US)
PLESIOTHERAPY
See RADIOTHERAPY
PLUMES
Development of a hazardous materials dispersion modeling capability with application to ambient air monitoring network design: Project plan, 15:3465 (R;US)
Evaluation of the ground-water contaminant plume extending from the 183-H Solar Evaporation Basins, 15:2225 (R;US)
The identification of terrain-induced circulations using principal components, 15:2230 (R;US)
PLUTONIUM
A review of the literature on the toxicity of rare-earth metals as it pertains to the Engineering Demonstration System surrogate testing, 15:3792 (R;US)
Analytical studies of plutonium containing solutions by Laser-Raman-Spectroscopy (LRS) with special regard to the Pu(IV)-Ru(III)-HNO_3 and Pu(VI)-H_2O_2-reactions, 15:3064 (R;DE;In German)
Environmental considerations for the conduct of surrogate tests in the Engineering Demonstration System, 15:3791 (R;US)
Magnetic separation as a plutonium residue enrichment process, 15:2203 (R;US)
Measurements of plutonium residues from recovery processes, 15:2246 (R;US)
Recent plutonium metal production experience at Hanford, 15:2171 (R;US)
PLUTONIUM 239
Electrodeposition and evaporation techniques used for preparation of ^{239}Pu sources. Determination by alpha spectrometry, 15:3052 (R;BR;In Portuguese)
PLUTONIUM COMPOUNDS
Analytical studies of plutonium containing solutions by Laser-Raman-Spectroscopy (LRS) with special regard to the Pu(IV)-Ru(III)-HNO_3 and Pu(VI)-H_2O_2-reactions, 15:3064 (R;DE;In German)
Plutonium diffusivity in compacted bentonite, 15:2223 (R;JP)
PNEUMOCONIOSES
Asbestos and silicate pollution in the work place. January 1978-July 1989 (Citations from Pollution Abstracts). Report for January 1978-July 1989, 15:3461 (R;US)
Technique for chest radiography for pneumoconiosis, 15:3678 (R;US)
POINT CHARGE
Stopping power and energy loss cross section of a point charge penetrating through a dense medium of bound electrons, 15:4205 (R;US)
POISONS (CHEMICAL)
See HAZARDOUS MATERIALS
POLAR REGIONS
See also ANTARCTIC REGIONS
Auroral energy deposition over the polar ionosphere during substorms. Technical report, 15:3882 (R;US)
POLARIZED BEAMS
Development of polarized ion beams and polarized gas targets: Final scientific report, 15:3286 (R;US)
Scatterings and reactions by means of polarized neutron beam, 15:4080 (RA;JP;In Japanese)
The design and performance of the FNAL high-energy polarized beam facility, 15:3271 (R;US)
POLARIZED TARGETS
Development of polarized ion beams and polarized gas targets: Final scientific report, 15:3286 (R;US)
POLLUTANTS
Concentration profiles from lidar measurements in the presence of multiple scattering: the two-stream approximation, 15:3473 (J;US)
Distribution of heavy metals and anions in the groundwater of quaternary gravel deposits in the Munich area (Dornach). Laboratory and field test results, 15:3540 (R;DE;In German)
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)
Vertical distribution of pollutants in the presence of convective storms, 15:3406 (R;US)
POLLUTION
See also AIR POLLUTION
LAND POLLUTION
THERMAL POLLUTION
WATER POLLUTION
Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)
POLLUTION (THERMAL)
See THERMAL POLLUTION
POLLUTION ABATEMENT
See also AIR POLLUTION ABATEMENT
EPA's (Environmental Protection Agency's) approach to pollution prevention, 15:2595 (R;US)
POLLUTION CONTROL EQUIPMENT
See also AIR FILTERS
CATALYTIC CONVERTERS
ELECTROSTATIC PRECIPITATORS
Quantitative evaluation of air-filtration systems in use at asbestos abatement sites: Research in progress, 15:3256 (R;US)
POLLUTION SOURCES
ROD (Record of Decision) annual report, FY 1988, 15:3590 (R;US)
POLOIDAL DIVERTORS
See POLOIDAL FIELD DIVERTORS
POLOIDAL FIELD DIVERTORS
Equilibrium shape control in CIT [Compact Ignition Tokamak] PF [poloidal field] design, 15:4391 (R;US)
POLY(ISOBUTYLENE OXIDE)
See EPOXIDES
ORGANIC POLYMERS
POLY(VINYLIDENE FLUORIDE)
See FLUORINATED ALIPHATIC HYDROCARBONS
POLYACETYLENES
Electronic structure of kink and kink-antikink defects in polyacetylene, 15:3027 (J;US)
Structural, electronic, and optical properties of polyacetylene from a total-energy local-density molecular-cluster approach, 15:3026 (J;US)
POLYACRYLATES
Synthesis of acrylic prepolymer, 15:2983 (R;MY)
POLYACRYLONITRILE
See ORGANIC POLYMERS
POLYAMIDES
A new approach in ultrapurification of coal by selective flocculation: Annual report, 15:2024 (R;US)

POLYATOMIC MOLECULES
Solution of reference interaction site model for mixtures of short-chain polyatomic molecules, 15:3932 (J;US)
Some new theoretical methods for treating reaction dynamics in polyatomic molecular systems, 15:3079 (R;US)

POLYCYCLIC AROMATIC AMINES
Comparison of the production and phenotypic properties of altered hepatocyte foci in rats initiated with diethylnitrosamine neonatally or after partial hepatectomy in early adulthood, 15:3599 (R;US)

POLYETHERS
See POLYETHYLENE GLYCOLS

POLYETHYLENE GLYCOLS
A new approach in ultrapurification of coal by selective flocculation: Annual report, 15:2024 (R;US)
Near-edge x-ray-absorption fine-structure spectroscopy investigation of poly(ethylene oxide)-KI complexes, 15:3035 (J;US)

POLYETHYLENE OXIDES
See POLYETHYLENE GLYCOLS

POLYETHYLENES
Development of short-term tests for evaluating plastic gas-piping materials. Annual report, January-December 1984, 15:2150 (R;US)
Gamma-ray irradiation effects of poly(ethylene-2, 6-naphthalate) and poly(ethylene-terephthalate), 15:2972 (R;JP;In Japanese)
Gels and foams from ultrahigh molecular weight polyethylene, 15:2986 (R;US)
Hydrogen permeability coefficient determinations for used waste drum liners, 15:2985 (R;US)
Molecular dynamics of laser ablation of a polymer coating, 15:3002 (J;US)

POLYMERS
See also ELASTOMERS
ORGANIC POLYMERS
A new polymer-based hydrogen getter, 15:2993 (BA;US)
Amperometric biosensors for glucose, lactate, and glycolate based on oxidases and redox-modified siloxane polymers, 15:3600 (R;US)
Cell performance of ultra-thin polymer-cathode system: Theoretical energy and power-density projections. Technical report No. 3, July 1988-June 1989, 15:2568 (R;US)
Integral equation theory of the structure and thermodynamics of polymer blends, 15:3022 (J;US)
Metal substrates and the photodegradation of polymers. Pt. 2. An FTIR study of polyethylene terephthalate and polyvinyl fluoride, 15:2344 (J;NL)
Solution of reference interaction site model for mixtures of short-chain polyatomic molecules, 15:3932 (J;US)
Studies of polymer foam morphology with FIR [far-infrared radiation] laser scattering, 15:2987 (R;US)
Surface exponents of trails in two dimensions at tricriticality: Computer simulation study, 15:3016 (J;US)
Synthesis and properties of new preceramic materials: Research progress report, December 1, 1988–November 30, 1989, 15:2970 (R;US)
Thermodynamic principles of the process of the effect of electromagnetic fields on a polymer melt, 15:3799 (R;US)

POLYOLEFINS
See also POLYETHYLENES
High-temperature gel-permeation chromatography of poly(4-methyl-1-pentene), 15:3063 (R;US)

POLYSULFIDES
See SULFIDES

POLYTETRAOXANE
See ORGANIC POLYMERS

POLYTHENE
See POLYETHYLENES

POLYTHIONATES
See SULFUR COMPOUNDS

POLYTHIONIC ACIDS
See SULFUR COMPOUNDS

POLYVINYL CHLORIDE
See PVC

POPULATION DYNAMICS
Establishment of a viable population of red-cockaded woodpeckers at the Savannah River Site: Progress report, FY 1989, 15:3492 (R;US)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Alewife and blueback herring, 15:3536 (R;US)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest): Brown rockfish, copper rockfish, and black rockfish, 15:3537 (R;US)

POPULATIONS
See also HUMAN POPULATIONS
Natural background radiation and population dose distribution in India, 15:4190 (R;IN)
Survey of Columbia River Basin streams for giant Columbia River spire snail Fluminicola columbiana and great Columbia River limpet Fisherola nuttalli, 15:3541 (R;US)

PORE STRUCTURE
See MICROSTRUCTURE

POROSITY REDUCTION
See FORMATION DAMAGE

PORPHYRINS
Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 8, June 15, 1989–September 15, 1989, 15:2021 (R;US)

POSITION SENSITIVE DETECTORS
Neutron range spectrometer, 15:3359 (P;US)
Si ring counters for detection of evaporation residues, 15:3340 (RA;DE;In German)

POSITRON CAMERAS
Robust spatial calibration of a planar positron camera. Final report, October 1985-September 1987, 15:3614 (R;US)

POSITRON COMPUTED TOMOGRAPHY
Robust spatial calibration of a planar positron camera. Final report, October 1985-September 1987, 15:3614 (R;US)

POTABLE WATER
See DRINKING WATER

POTASSIUM
U, Th and K distributions inferred from regional geology and the terrestrial radiation profiles in India, 15:3505 (R;IN)

POTASSIUM ALLOYS
Structural properties of liquid alkali-metal–lead alloys: NaPb, KPb, RbPb, and CsPb, 15:2887 (J;US)

POTASSIUM COMPOUNDS
See also POTASSIUM IODIDES
POTASSIUM OXIDES
Nature of phonons, isotope effect, and superconductivity in $Ba_{1-x}K_xBiO_3$, 15:2910 (R;US)

POTASSIUM IODIDES
Near-edge x-ray-absorption fine-structure spectroscopy investigation of poly(ethylene oxide)-KI complexes, 15:3035 (J;US)

POTASSIUM IONS
Optically based potassium sensor, 15:3372 (R;US)

POTASSIUM OXIDES
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)
Superconducting energy gap and a normal-state excitation in $Ba_{0.6}K_{0.4}BiO_3$, 15:2958 (J;US)

POULTRY
See FOWL

POWDERS
[Ceramic powder processing]: Foreign trip report, October 7–15, 1988, 15:2930 (R;US)

POWER BURST FACILITY USAEC
See PBF REACTOR

POWER GENERATION
See also COGENERATION
ON-SITE POWER GENERATION
Comparison of advanced power generation technologies using computer simulations, 15:2409 (R;US)
Electricity production at fuel cell power plants, 15:3252 (R;FI;In Finnish)
The role of oil in electricity generation in five European countries: Past, present, and potential, 15:2631 (R;US)

Use of a fish transportation barge for increasing returns of steelhead imprinted for homing: Final report, 15:2280 (R;US)

POWER PLANTS
See also DUAL-PURPOSE POWER PLANTS
FUEL CELL POWER PLANTS
GAS TURBINE POWER PLANTS
HYDROELECTRIC POWER PLANTS
WIND POWER PLANTS
Walk-through survey report: Northeast Utilities Service Co./Stone and Webster Engineering Corp., Millstone Plant No. 3, Waterford, Connecticut, August 29, 1979, 15:3770 (R;US)

POWER POOLING
Dynamic cooperative electricity exchange in a power pool. Research report, 15:2640 (R;FI)

POWER REACTORS
See also ANGRA-1 REACTOR
BROWNS FERRY-2 REACTOR
CHERNOBYLSK-4 REACTOR
COMANCHE PEAK-1 REACTOR
COMANCHE PEAK-2 REACTOR
EBR-2 REACTOR
FITZPATRICK REACTOR
HBWR REACTOR
INDIAN POINT-2 REACTOR
KALPAKKAM-1 REACTOR
KALPAKKAM-2 REACTOR
LOVIISA-1 REACTOR
LOVIISA-2 REACTOR
SHIPPINGPORT REACTOR
SPACE POWER REACTORS
TVO-1 REACTOR
TVO-2 REACTOR
THREE MILE ISLAND-2 REACTOR
Incorporating fuzzy data and logical relations in the design of expert systems for nuclear reactors, 15:2483 (BA;US)
Power reactor information system (PRIS). Reference and online access manual, 15:2434 (R;XA)
Trend and pattern analysis of operational data through cooperation between OECD countries, 15:2498 (R;FR)

POWER SUPPLIES
See also SPACECRAFT POWER SUPPLIES
A simple implementation of a power supply for constant phototube current in light modulation spectroscopy, 15:3376 (J;US)
Computer systems protection: Uninterruptible power supplies. January 1983-September 1989 (Citations from the Computer data base). Report for January 1983-September 1989, 15:4523 (R;US)
Development and refinement of test bed simulations, 15:2416 (R;US)

PRASEODYMIUM OXIDES
Electronic structure of $Pb_2Sr_2PrCu_3O_8$ as studied by resonant photoemission spectroscopy, 15:2956 (J;US)
Neutron-powder-diffraction study of the structure and antiferromagnetic ordering in Pr_2CuO_4, 15:3031 (J;US)
Solid oxide fuel cells electrodes based on IN_2O_3-$PRrO_{1.83}$-ZrO_2, 15:2659 (R;US)

PRECIPITATIONS (ATMOSPHERIC)
See ATMOSPHERIC PRECIPITATIONS

PRECOMPOUND-NUCLEUS EMISSION
Partial level densities in precompound reactions, 15:4141 (RA;DE)
Statistical theory of precompound reactions: The multistep direct process, 15:4143 (RA;DE)

PREEQUILIBRIUM NUCLEAR PROCESSES
See PRECOMPOUND-NUCLEUS EMISSION

PREFABRICATED BUILDINGS
Resource saving cassette building system for low energy houses, 15:2674 (R;DK;In Danish)

PRESERVATIVES
Evaluation of emission sources from creosote wood-treatment operations. Final report, 15:2747 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Wood-treating industries, 15:2737 (R;US)
Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988, 15:3533 (R;US)

PRESSURE VESSELS
An interior vessel viewing system for DIII-D, 15:4408 (R;US)
Elastic-plastic fracture mechanics analysis of a pressure vessel with an axial outer surface flaw. Technical report, 15:2531 (R;DE;In German)
Engineering approaches to the application of fracture toughness data in the nuclear industry, 15:2820 (R;US)
Irradiation programs to establish the safety margins of German licensing rules related to RPV steel embrittlement, 15:2465 (R;DE)
Location and repair of air leaks in the ATF [Advanced Toroidal Facility] vacuum vessel, 15:4390 (R;US)
Mechanical design of an infrared imaging system for DIII-D, 15:4414 (R;US)
The consideration of irradiation embrittlement of RPV steels in German licensing rules as compared to recent results of irradiation experiments, 15:2835 (R;DE)
[Integrity of pressure components of nuclear power plants]: Foreign trip report, October 3, 1989–October 20, 1989, 15:2553 (R;US)

PRESSURIZED WATER COOLED MODERATED REACTOR
See PWR TYPE REACTORS

PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS

PRIMARY COSMIC RADIATION
Acceleration of cosmic rays in SNR shock waves, 15:3823 (RA;DE;In German)
Cosmic ray spectrum produced by supernova remnants with an upper limit on wave dissipation, 15:3824 (RA;DE;In German)
Nonlinear waves in cosmic ray magnetohydrodynamics, 15:3825 (RA;DE;In German)
Stochastic acceleration of relativistic particles, 15:3826 (RA;DE;In German)

PRINTED CIRCUITS
Cure analysis of printed-circuit boards containing reactive adhesive layers, 15:3226 (R;US)
Microwave coupling phenomenology of pc [printed-circuit] boards, 15:3227 (R;US)

PRINTING AND PUBLISHING INDUSTRY
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Printing and publishing, 15:2738 (R;US)

PROBABILITY
Compromise prior on the basis of maximum entropy, 15:4261 (R;US)

PROBES
Development and utilization of new diagnostics for dense-phase pneumatic transport: Quarterly technical progress report, July 1, 1989–September 30, 1989, 15:2084 (R;US)

PROCESS HEAT
Process integration initiative. A review of the process integration activities funded under the Energy Efficiency R and D programme, 15:2732 (R;GB)

PROCESSING (DATA)
See DATA PROCESSING

PROCESSING (ORES)
See ORE PROCESSING

PROCESSING (WASTES)
See WASTE PROCESSING

PRODUCTION
Calculation of peat production expenses, 15:2088 (R;FI;In Finnish)
Development of a mesuring method for the efficiency of milled peat production, 15:2089 (R;FI;In Finnish)

PRODUCTION (HYDROGEN)
See HYDROGEN PRODUCTION

PRODUCTION (PARTICLE)
See PARTICLE PRODUCTION

PRODUCTION (PLASMA)
See PLASMA PRODUCTION

PRODUCTION REACTORS
A preliminary modeling and analysis framework for severe accident analysis of high power density research reactors, 15:2528 (R;AT)
PRODUCTIVITY FACTOR
See FORMATION DAMAGE
PROGRAM MANAGEMENT
Geotechnical support and topical studies for nuclear waste geologic repositories: Annual report, fiscal year 1988, 15:2208 (R;US)
Technical skills training program: Program management, project management, procurement and assistance, 15:4489 (R;US)
PROJECT MANAGEMENT
See PROGRAM MANAGEMENT
PROJECTILES
Method for predicting the impact velocity of a projectile fired from a compressed air gun facility, 15:3122 (R;GB)
PROPELLANTS
Shock-wave characterization of energetic booster-rocket propellant WAK-2 and its simulant UGS, 15:2260 (R;US)
PROPORTIONAL COUNTERS
Construction of a new 4π parallel plate detector for the Crystal Ball, 15:3341 (RA;DE;In German)
PROPULSION SYSTEMS
Antiproton powered propulsion with magnetically confined plasma engines, 15:2780 (R;US)
Electrothermal guns – a theoretical investigation of factors for optimal performance. Technical report, 15:2660 (R;US)
Method for predicting the impact velocity of a projectile fired from a compressed air gun facility, 15:3122 (R;GB)
Nuclear electric propulsion for near-term space missions, 15:2652 (BA;US)
PROTECTION (CORROSION)
See CORROSION PROTECTION
PROTECTION (RADIATION)
See RADIATION PROTECTION
PROTECTIVE COATINGS
Corrosion-resistant coatings. February 1983-September 1989 (Citations from the NTIS data base). Report for February 1983-September 1989, 15:2848 (R;US)
Thermal barrier coating life prediction model, 15:2926 (RA;US)
Thermal barrier coating life prediction model development, 15:2927 (RA;US)
Thermal barrier coating life-prediction model development, 15:2925 (RA;US)
Thermal expansion mismatch and plasticity in thermal barrier coating, 15:2924 (RA;US)
PROTEINS
See also PEPTIDES
Combined capillary electrophoresis and electrospray ionization mass spectrometry, 15:3371 (R;US)
PROTON DETECTION
Study of the energetic proton production in relativistic heavy ions Ne + nuclei collisions, using Diogene detector. Hadronic matter temperature, 15:4068 (R;FR;In French)
PROTON REACTIONS
Cold nuclear fusion in metallic hydrogen and normal metals, 15:4169 (J;US)
Contribution of two-pion annihilation to dilepton emission from proton-nucleon collisions, 15:4008 (J;US)
Dirac random-phase-approximation analysis of the inelastic scattering of 500 MeV protons from ^{40}Ca, 15:4170 (J;US)
Semiclassical distorted wave theory of inclusive nucleon inelastic scattering to continuum, 15:4165 (RA;JP;In Japanese)
Time of flight measurements at the pulsed proton beam, 15:4076 (RA;DE;In German)
Workshop for cascade project, physics using large acceptance spectrograph and its technical considerations, 15:4069 (R;JP;In Japanese)
PROTON-ANTIPROTON INTERACTIONS
Low energy $\bar{p}p$ physics, 15:3960 (R;US)
Measurement of proton-antiproton cross sections at low momenta, 15:3955 (RA;DE;In German)
Polarization asymmetries of large P_t leptons at hadron colliders in E_6 theories, 15:3989 (R;XA)
Recent results from the CDF [Collider Detector at Fermilab] experiment at the Tevatron proton-antiproton collider, 15:3953 (R;US)
PROTON-NEUTRON INTERACTIONS
Global trends and structural consequences of the proton-neutron interaction, 15:4125 (R;US)
PROTON-PROTON INTERACTIONS
Contribution of two-pion annihilation to dilepton emission from proton-nucleon collisions, 15:4008 (J;US)
Jet production and decay in relativistic pp collisions, 15:3995 (RA;DE)
PROTONS
See also SOLAR PROTONS
First test of the Siberian snake magnet arrangement to overcome depolarizing resonances in a circular accelerator, 15:3281 (J;US)
Search for proton decay and supernova neutrino bursts with a lunar base neutron detector, 15:3954 (R;XA)
PSEUDOPARTICLES
See INSTANTONS
PUBLIC BUILDINGS
Health-hazard evaluation report HETA 88-372-1953, Barbados Ministry of Health, Bridgetown, Barbados, 15:3459 (R;US)
PUBLIC HEALTH
Methods used in the United States for the assessment and management of health risk due to chemicals, 15:3773 (R;US)
Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)
PUBLIC POLICY
Summary of commercial conservation programs environmental issues and program consistency, 15:3517 (R;US)
US Energy use: New technologies and policies in response to global warming, 15:3408 (R;US)
PUBLIC RELATIONS
Community relations programs: Improved planning through better understanding of communication systems, 15:2592 (R;US)
PUBLIC UTILITIES
See also ELECTRIC UTILITIES
WATER UTILITIES
Least-cost planning in the utility sector: Progress and challenges: Volume 2, Technical appendix, 15:2624 (R;US)
The practice of utility least-cost planning: A report on a study-in-progress, 15:2633 (R;US)
PUGET SOUND
Comparison of bioassays for assessing sediment toxicity in Puget Sound. (Appendices included). Report for 1988-1989 (Final), 15:3561 (R;US)
PULMONARY CANCER
See CARCINOMAS
PULMONARY LAVAGE
See LUNGS
PULSATING VARIABLE STARS
See also CEPHEIDS
Nonlinear pulsations of luminous He stars, 15:3873 (BA;US)
PULSE COMBUSTION
Pulsating catalytic combustion of gaseous fuels. Final report, January 1987-September 1988, 15:2152 (R;US)
PULSE GENERATORS
See also HIGH-VOLTAGE PULSE GENERATORS
Computer controlled MHD power consolidation and pulse-generation system: Technical progress report, October 1988–March 1989, 15:2648 (R;US)
PULVERIZED FUEL ASH
See FLY ASH
PUMPS
See also WATER PUMPS
Closeout of IE Bulletin 86-01: Minimum flow logic problems that could disable residual heat removal pumps: Minimum flow logic problems that could disable residual heat removal pumps, 15:2544 (R;US)

Probabilistic structural analysis methods of hot engine structures, 15:3248 (R;US)

PURINES
See also ADENINES
GUANINE
Matrix-isolation of free radicals from purines and derivatives in aqueous low temperature glasses, 15:3713 (RA;DE)
Pulse radiolysis studies on one-electron oxidation of purines, 15:3720 (RA;DE)

PURITY
See IMPURITIES

PVC
Hydrogen permeability coefficient determinations for used waste drum liners, 15:2985 (R;US)

PWR TYPE REACTORS
See also ANGRA-1 REACTOR
COMANCHE PEAK-1 REACTOR
COMANCHE PEAK-2 REACTOR
INDIAN POINT-2 REACTOR
LOFT REACTOR
SHIPPINGPORT REACTOR
THREE MILE ISLAND-2 REACTOR

Aging
Embrittlement of cast stainless steels in LWR systems, 15:2513 (R;US)

Fission Product Release
In-core thermal hydraulic and fission product calculations for severe fuel damage analyses, 15:2438 (R;US)

Fuel Element Failure
Study on the behavior of PWR remedy fuel under reactivity initiated accident conditions. Effect of pellet shape modification, 15:2533 (R;JP;In Japanese)
Study on the behavior of waterside corroded PWR fuel rods under reactivity initiated accident conditions, 15:2535 (R;JP;In Japanese)

Fuel Elements
Advancements in the behavioral modeling of fuel elements and related structures, 15:2504 (R;US)

Fuel Pellets
Study on the behavior of PWR remedy fuel under reactivity initiated accident conditions. Effect of pellet shape modification, 15:2533 (R;JP;In Japanese)

Fuel Rods
Design and operation of gamma scan and fission gas sampling systems for characterization of irradiated commercial nuclear fuel, 15:2440 (R;US)
Study on the behavior of waterside corroded PWR fuel rods under reactivity initiated accident conditions, 15:2535 (R;JP;In Japanese)

Heat Transfer
Heat transfer, 15:2805 (B;US)

Loss Of Coolant
Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4, 15:2547 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
Multiloop integral system test (MIST): Test Group 35, Noncondensibles and venting: Final report: Volume 7, 15:2549 (R;US)
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)
Review of LOFT [Loss-of-Fluid Test] large break experiments: OECD LOFT project, 15:2551 (R;US)
Scale model test results for an inverted U-tube steam generator with comparisons to heat transfer correlations, 15:2518 (R;US)

Meltdown
Measures for reduction of severe accident consequences: Comprehensive evaluation of the results sponsored by the BMI, 15:2495 (R;DE;In German)

Pipes
Deposition of cobalt on surface-treated stainless steel under PWR conditions, 15:2445 (R;US)

Pressure Vessels
[Integrity of pressure components of nuclear power plants]: Foreign trip report, October 3, 1989–October 20, 1989, 15:2553 (R;US)

Radioactive Effluents
Radioactive materials released from nuclear power plants: Annual report, 1987, 15:2540 (R;US)

Reactor Accidents
A standard problem for HECTR-MAAP [Hydrogen Event: Containment Transient Responses-Modular Accident Analysis Program] comparison: In-cavity oxidation, 15:2541 (R;US)

Reactor Cooling Systems
Aging assessment of auxiliary feedwater systems, 15:2511 (R;US)

Reactor Kinetics
ARMP-02 documentation: Part 2, Chapter 5, EPRI-PRESS computer code manuals: Volume 1, Theory and numerics, 15:2525 (R;US)

Reactor Physics
ARMP-02 documentation: Part 2, Chapter 5, EPRI-PRESS computer code manuals: Volume 1, Theory and numerics, 15:2525 (R;US)

Spent Fuels
Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)

Steam Generators
Determination of thermodynamic data for modeling corrosion: Final report, Volume 2: Chlorides and acetates, 15:2444 (R;US)
Determination of thermodynamic data for modeling corrosion: Volume 1, Sulfates (Revision 1): Final report, 15:2443 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)

Thorium Oxides
Program of research and development on the thorium utilization in PWRS. Final report (1979-1988), 15:2449 (R;DE)

PYRITE
Enhancement of surface properties for coal benefication: Progress report, August 1, 1989–September 30, 1989, 15:2056 (R;US)
[Advanced physical fine coal cleaning: Froth flotation]: Quarterly technical progress report, July 1, 1989–September 30, 1989, 15:2016 (R;US)

PYRITES
See PYRITE

Q

QUALITY CONTROL
Back to basics, 15:2753 (R;US)

QUANTITATIVE CHEMICAL ANALYSIS
Elementary analysis by means of the x fluorescence and energy dispersion, 15:3066 (R;FR;In French)
Energy calibration and quantitative analysis with ESCA, 15:3351 (RA;DE;In German)

QUANTUM CHROMODYNAMICS
Finite temperature QCD with four light quark flavours, 15:4005 (J;NL)
Four-flavor QCD with intermediate- and light-mass quarks, 15:4060 (J;US)
How does one see QCD degrees of freedom in physics of interacting hadrons?, 15:4000 (RA;DE;In German)
Low $_{rho}$perpendicular properties of the pomeron: Theoretical implications in QCD, 15:4047 (BA;US)
One-jet inclusive cross section at order α_s^3. I. Gluons only, 15:4011 (J;US)
Renormalization scheme dependence in the next-to-next-to-leading order and the high energy behaviour in QCD, 15:3990 (R;XA)
Scattering amplitudes in hot gauge theories, 15:4052 (J;US)
Soliton baryons and Goldstone mesons in the cell model of the QCD vacuum, 15:3997 (RA;DE)
What is the order of the transition from hadronic matter to the quark-gluon plasma?, 15:4006 (J;NL)

QUANTUM ELECTRODYNAMICS
See also SCHWINGER-TOMONAGA FORMALISM
Structure functions and initial-final state interference in QED, 15:4042 (R;IT)

QUANTUM FIELD THEORY
See also LAGRANGIAN FIELD THEORY
LATTICE FIELD THEORY
QUANTUM CHROMODYNAMICS
QUANTUM ELECTRODYNAMICS
QUANTUM GRAVITY
Geometry and quantization of topological gauge theories, 15:4041 (R;XA)
Level-one SU(3) Wess-Zumino model on higher genus Riemann surfaces, 15:4036 (R;XA)
Pair production in an electric field in a time-dependent gauge, 15:4040 (R;XA)
Quantum groups, braiding matrices and coset models, 15:4034 (R;US)
Solution of a class of conformal quantum field theory models in D-dimensional space, 15:4038 (R;XA)
Variational calculations in gauge theories, 15:4051 (J;US)

QUANTUM FLUIDS
Cumulant methods and short time propagators, 15:4299 (J;US)
Quantum fluids and solids, 1989, 15:3938 (B;US)

QUANTUM GRAVITY
Simultaneous creation of electron-positron pairs and photons in Robertson-Walker universes with statically bounded expansion, 15:4035 (R;XA)

QUANTUM MECHANICS
Generalized canonical quantization of dynamical systems with constraints and curved phase space, 15:4272 (R;XA)
How probability arises in quantum mechanics, 15:4291 (J;US)
Quantum sl(2) enveloping algebra and representations of braid group, 15:4271 (R;XA)
The finite temperature mean-field description and thermal fluctuations, 15:4283 (RA;DE)
The sense in which a "weak measurement" of a spin- (1/2 particle's spin component yields a value 100, 15:4293 (J;US)
$U_q(sl(2))$ invariant operators and minimal theories fusion matrices, 15:4270 (R;XA)

QUARK CONFINEMENT
See BAG MODEL

QUARK MATERIAL
See QUARK MATTER

QUARK MATTER
Surface tension of strange-quark matter in the early Universe, 15:3880 (J;US)
Temporal development of the plasma phase transition, 15:4242 (J;US)
What is the order of the transition from hadronic matter to the quark-gluon plasma?, 15:4006 (J;NL)

QUARK MODEL
See also BAG MODEL
STRING MODELS
Nanti N-interaction, 15:4001 (RA;DE;In German)
Quark-mass dependence of the chiral model parameters, 15:3998 (RA;DE)
Soliton baryons and Goldstone mesons in the cell model of the QCD vacuum, 15:3997 (RA;DE)

QUARK PLASMA
See QUARK MATTER

QUARK SEA
See QUARK MATTER

QUARK-GLUON INTERACTIONS
Investigation of physical structures and interactions at high energy: [Progress report, October 1988–October 1989], 15:3949 (R;US)
Search for the quark-gluon plasma (1989): The NA35 experiment at the CERN SPS, 15:4066 (R;US)
Theoretical aspect of J/PSI production in nucleus-nucleus collisions, 15:3976 (R;FR)
Theoretical issues in the search for the quark gluon plasma, 15:4162 (R;US)

QUARK-GLUON PLASMA
See QUARK MATTER

QUARKS
Can $\theta_{QCD}=\pi$?, 15:4007 (J;US)
Four-flavor QCD with intermediate- and light-mass quarks, 15:4060 (J;US)
Search for supersymmetric particles at CDF, 15:3974 (R;US)
Super-hypernuclei in the quark-shell model, 2, 15:4002 (R;JP)
Z-boson bremsstrahlung in heavy-quark decay, 15:4014 (J;US)

QUASI PARTICLES
See also INSTANTONS
SOLITONS
Frequency dependence of quasi-particle mixers, 15:3118 (R;US)

R

RABBITS
Gamma-radiation affects active electrolyte transport by rabbit ileum. 2. Correlation of alanine and theophylline response with morphology, 15:3689 (R;US)

RADIATION ACCIDENTS
1988 changes to United States law regarding nuclear third party liability, 15:2615 (R;US)
Nursering assistance to the radiological accident patients in Goias-Brazil, 15:3697 (R;BR;In Portuguese)
Radiological survey of Goiania by a mobile monitoring unit, 15:4186 (R;BR)
The development and revision of the Federal Radiological Emergency Response Plan, 15:2512 (R;US)

RADIATION BELTS
Space radiation environment at 840 km, 15:3881 (R;US)

RADIATION BURDEN
See RADIATION DOSES

RADIATION CHEMISTRY
The Radiological Research Accelerator Facility: Progress report, December 1, 1988–November 30, 1989, 15:3695 (R;US)

RADIATION CURING
Electron beam (EB) curing of wood surface finishing - lamination of PVC film on wood substrates. Final report STA scientist exchange program JAERI, Takasaki, Japan (September to November 1988), 15:2256 (R;MY)
Preparation methodology of radiation - curable resin. Unsaturated polyesters, 15:2255 (R;MY)

RADIATION DAMAGE (BIOLOGICAL)
See RADIATION INJURIES

RADIATION DAMAGE (NONBIOLOGIC)
See RADIATION EFFECTS

RADIATION DECONTAMINATION
See DECONTAMINATION

RADIATION DETECTORS
See also CHERENKOV COUNTERS
CRYSTAL COUNTERS
IONIZATION CHAMBERS
NEUTRON DETECTORS
POSITION SENSITIVE DETECTORS
PROPORTIONAL COUNTERS
SHOWER COUNTERS
Evaluation of a linear photodiode array detector for synchrotron small-angle x-ray scattering measurements, 15:3231 (J;US)
Improved charge collection of the buried p-i-n a-Si:H radiation detectors, 15:3354 (R;US)

RADIATION DOSES
Handbook of selected tissue doses for projections common in diagnostic radiology, 15:3679 (R;US)
Procedure to estimate radiation dose in the population in the case of an accident, 15:2499 (R;BR;In Portuguese)

RADIATION EFFECTS
See also BIOLOGICAL RADIATION EFFECTS
Modeling casualties in nuclear warfare. Final report, 15:3385 (R;US)

RADIATION EXPOSURE (DOSES)
See RADIATION DOSES

RADIATION HAZARDS
Demonstration of a computer model for residual radioactive material guidelines, RESRAD, 15:2183 (R;US)
Radiation hazard from the tantalum dumps in Penang, 15:2244 (R;MY)

RADIATION HYGIENE
See RADIATION PROTECTION

RADIATION INDUCED MUTANTS
Bud irradiation to obtain resistence to citrus canker through induction of mutation, 15:3686 (R;BR;In Portuguese)

RADIATION INJURIES
DNA damage in mammalian cells following heavy-ion irradiation, 15:3745 (R;US)
Dependence of local radiation complications on methods of intracavitary gamma-therapy in concomitant radiotherapy of stage 1 cervix uteri carcinoma, 15:3741 (RA;SU;In Russian)
Immediate results of concomitant radiotherapy of advanced forms of cervix uteri carcinoma with the use of thymaline, 15:3663 (RA;SU;In Russian)
Immunologic status of patients with epidermoid lung cancer in radiotherapy on split course and chemoimmunotherapy, 15:3665 (RA;SU;In Russian)
Injuries of healthy tissues in nontraditional regimen of dose fractionating in patients with cervix uteri carcinoma, 15:3662 (RA;SU;In Russian)
Mathematical model for evaluation of delayed injuries of rectum in radiotherapy, 15:3738 (RA;SU;In Russian)
Peculiarities of surgical treatment of patients with radiation injuries, 15:3661 (RA;SU;In Russian)
Radiation damage and its influence on source requirements for high resolution x-ray holography, 15:3680 (R;US)
Radiation injuries following repeated irradiation by mean dose fractionating of multiple bone metastases of breast cancer, 15:3740 (RA;SU;In Russian)
Treatment of laser-induced retinal injuries. Final report, 12 February 1985-31 January 1987, 15:3797 (R;IL)

RADIATION MONITORING
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)
ISIS: An Interactive System for Instruction and Sampling, 15:3483 (R;US)
Report of radioactivity survey research in fiscal year 1987, 15:4194 (R;JP;In Japanese)

RADIATION MONITORS
The continuing saga of alpha CAM [continuous air monitor] development at Los Alamos, 15:3482 (R;US)

RADIATION PROTECTION
A new initiative on radiation coordination in the federal government, 15:2556 (BA;US)
Abstracts of 14th radiation hygiene days, 15:4191 (R;CS;In Czech, Slovak)
Directory of certificates of compliance for radioactive materials packages: Report of NRC approved quality assurance programs for radioactive materials packages: Volume 3: Revision 9, 15:3132 (R;US)
Quality-assurance plan for the Basic Environmental Compliance and Monitoring Program (BECAMP), 15:3744 (R;US)
Radiation physics, biophysics, and radiation biology: Progress report, December 1, 1988–November 30, 1989, 15:3694 (R;US)
Risk assessment and risk management for an experimental nuclear waste processing facility, 15:2193 (R;US)

RADIATION SAFETY
See RADIATION PROTECTION

RADIATION SOURCES
See also SEALED SOURCES
SYNCHROTRON RADIATION SOURCES
Oil wells and gas wells: aspects of radiological safety, 15:2123 (R;BR;In Portuguese)

RADIATION SYNDROME
Acute radiation syndrome in the ^{137}Cs Brazilian accident, 1987, 15:3698 (R;BR)

RADIATION TRANSPORT
Symbolic implicit Monte Carlo, 15:4181 (J;US)

RADICALS
See also CARBENES
HYDROXYL RADICALS
SUPEROXIDE RADICALS
Matrix-isolation of free radicals from purines and derivatives in aqueous low temperature glasses, 15:3713 (RA;DE)
Oxidative DNA sugar damage by targeted antibiotic free radicals, 15:3704 (RA;DE)
Spin trapping of sugar radicals in solid and aqueous phases, 15:3726 (RA;DE)

RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES

RADIOACTIVE EFFLUENTS
Population dose commitments due to radioactive releases from nuclear power plant sites in 1986, 15:2539 (R;US)
Standard Review Plan for a petition for rulemaking on radioactive waste streams below regulatory concern: Expedited review in accordance with Appendix B to 10 CFR, Part 2: Data report for comment, 15:2213 (R;US)

RADIOACTIVE GASEOUS WASTES
See GASEOUS WASTES
RADIOACTIVE WASTES

RADIOACTIVE MATERIALS
See also FISSION PRODUCTS
RADIOACTIVE WASTES
Applied exposure modeling for residual radioactivity and release criteria, 15:3693 (R;US)
Directory of certificates of compliance for radioactive materials packages: Certificates of compliance: Volume 2, Revision 12, 15:2174 (R;US)
Directory of certificates of compliance for radioactive materials packages: Report of NRC approved packages: Volume 1, Revision 12, 15:2173 (R;US)
Directory of certificates of compliance for radioactive materials packages: Report of NRC approved quality assurance programs for radioactive materials packages: Volume 3: Revision 9, 15:3132 (R;US)
Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole, 15:3390 (R;US)
Quality Assurance in the removal and transport of the TMI-2 core, 15:2523 (R;US)
Safety in transport and storage of radioactive materials, 15:2172 (R;BR;In Portuguese)

RADIOACTIVE PARTICULATES
See PARTICLES

RADIOACTIVE WASTE DISPOSAL
Disposal in granite formations, 15:2197 (R;FR;In French)
Disposal in salt formations, 15:2198 (R;FR)
Disposal into the sub-seabed, 15:2199 (R;FR)
Management of tritium wastes in the United Kingdom. A survey of present and future arisings, review of possible disposal options and areas where further R and D may be needed to develop a management strategy for the future, 15:2179 (R;GB)
Natural analogue study of volcanic glass. A case study of basaltic glasses in pyroclastic fall deposits of Fuji volcano, Japan, 15:3804 (R;JP)
Performance assessment of geological isolation systems for radioactive waste. Disposal in clay formations, 15:2196 (R;FR)
Risk assessment and risk management for an experimental nuclear waste processing facility, 15:2193 (R;US)

RADIOACTIVE WASTE FACILITIES
See also WIPP
Earth Sciences Division annual report 1988, 15:3811 (R;US)
Evolution of pH in a radwaste repository: internal reactions between concrete constituents, 15:2178 (R;GB)
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 1, 15:2190 (R;US)
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 2, 15:2191 (R;US)
Nondestructive assay and nondestructive examination of remote-handled transuranic waste at the ORNL waste handling and packaging plant, 15:2181 (R;US)

Remediation of DOE hazardous waste sites: Planning and integration requirements, 15:2243 (R;US)
Waste Isolation Pilot Plant (WIPP) TRU waste shipment dry run preoperational checkout plan, 15:2192 (R;US)

RADIOACTIVE WASTE MANAGEMENT
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Verification, example and benchmark problems: Volume 3, 15:2217 (R;US)
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 1, 15:2190 (R;US)
OCRWM program elements change control procedures, 15:2188 (R;US)
Slurry-fed ceramic melter–A broadly accepted system to vitrify high-level waste, 15:2226 (R;US)
Training waste generators: The first responder in proper waste management, 15:2184 (R;US)
Waste Isolation Pilot Plant (WIPP) TRU waste shipment dry run preoperational checkout plan, 15:2192 (R;US)

RADIOACTIVE WASTE PROCESSING
Impact of technology applications to the management of low-level radioactive wastes, 15:2182 (R;US)
Sol-gel processes. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:2222 (R;US)

RADIOACTIVE WASTE STORAGE
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1, 15:2215 (R;US)
FLAC (Fast Lagrangian Analysis of Continua), Version 2.20: User's manual, 15:2216 (R;US)
Radioactive waste storage sites: Reclamation and remedial action. January 1970-July 1989 (Citations from the NTIS data base). Report for January 1970-July 1989, 15:2221 (R;US)

RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
HIGH-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Applicable or relevant and appropriate requirements (ARARs) for radioactive mixed waste, 15:2228 (R;US)

RADIOAPPLICATORS
See RADIATION SOURCES

RADIOBIOLOGICAL EFFECTS
See BIOLOGICAL RADIATION EFFECTS

RADIOBIOLOGY
The Radiological Research Accelerator Facility: Progress report, December 1, 1988–November 30, 1989, 15:3695 (R;US)
Theory of RBE: Annual progress report, January 1, 1989–December 31, 1989, 15:3617 (R;US)

RADIOCARBON DATING
See ISOTOPE DATING

RADIOCRYSTALLOGRAPHY
See CRYSTALLOGRAPHY

RADIOECOLOGICAL CONCENTRATION
Control of radon in houses, 15:2692 (R;US)
Environmental monitoring for radionuclides, chemicals, fish and wildlife at a US energy research facility: A case story, 15:3751 (R;US)
Investigation of radon entry and effectiveness of mitigation measures in seven houses in New Jersey, 15:2693 (R;US)
Results of the radiological survey at 9 Hancock Street, Lodi, New Jersey (LJ028), 15:3508 (R;US)

RADIOFREQUENCY SYSTEMS
See RF SYSTEMS

RADIOGRAPHY (BIOMEDICAL)
See BIOMEDICAL RADIOGRAPHY

RADIOGRAPHY (INDUSTRIAL)
See INDUSTRIAL RADIOGRAPHY

RADIOISOTOPE HEAT SOURCES
Interagency Nuclear Safety Review Panel: Safety evaluation report for Galileo: Volume 2, 15:2651 (R;US)
Safety evaluation report for Galileo: Volume 1, 15:2650 (R;US)

RADIOISOTOPE KINETICS
See RADIONUCLIDE KINETICS

RADIOISOTOPE MIGRATION
See RADIONUCLIDE MIGRATION

RADIOISOTOPES
Analytic solution of pseudocolloid migration in fractured rock, 15:2212 (R;US)
Mass transport in salt repositories: Transient diffusion into interbeds, 15:2206 (R;US)
Variable temperature effects on release rates of readily soluble nuclides: Revision, 15:2205 (R;US)

RADIOLOGICAL PROTECTION
See RADIATION PROTECTION

RADIONUCLIDE DISTRIBUTIONS
See RADIONUCLIDE KINETICS

RADIONUCLIDE KINETICS
Dynamic aspects of radioactive contamination of marine organisms. Proceeding of the 14th NIRS seminar on environmental research, 15:3570 (R;JP;In Japanese)

RADIONUCLIDE METABOLISM
See RADIONUCLIDE KINETICS

RADIONUCLIDE MIGRATION
Analysis of caisson transport experiments by travel time approach, 15:2201 (R;US)
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)
Environmental radionuclide concentrations in the vicinity of the peach bottom atomic power station: 1985-1986. Data report, 15:2456 (R;US)
Mass transport in salt repositories: Steady-state transport through interbeds, 15:2207 (R;US)
Population dose commitments due to radioactive releases from nuclear power plant sites in 1986, 15:2539 (R;US)
Radiological surveys of Naval facilities on Puget Sound. Final report, 15:3571 (R;US)
Release rates of soluble species at Yucca Mountain, 15:2210 (R;US)
Verification study of a three-dimensional local scale atmospheric model PHYSIC at seacoast region, 15:3479 (R;JP)

RADIONUCLIDE TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION

RADIONUCLIDE TRANSFER (IN ORGANISMS)
See RADIONUCLIDE KINETICS

RADIONUCLIDE TURNOVER
See RADIONUCLIDE KINETICS

RADIONUCLIDES
See RADIOISOTOPES

RADIOPROTECTIVE SUBSTANCES
ESR investigations of the reactions of radiation-produced thiyl and peroxyl radicals: Formation of sulfoxyl radicals, 15:3714 (RA;DE)

RADIORESISTANCE
See RADIOSENSITIVITY

RADIOSENSITIVITY
Change in proliferative activity of squamous cell and adenogenic carcinomas in the process of radiotherapy as a possible radiosensitivity index, 15:3657 (RA;SU;In Russian)
Prospects for development of radiotherapy of patients with esophagus cancer (role of modifying factors), 15:3643 (RA;SU;In Russian)

RADIOSURGERY
See RADIOTHERAPY

RADIOTHERAPY
See also AFTERLOADING

Biological Radiation Effects
Intracavitary radiotherapy of malignant tumors of rectum, 15:3653 (RA;SU;In Russian)
Quality garantee of radiotherapy of patients with lung cancer, 15:3650 (RA;SU;In Russian)

Blood Chemistry
Chemoluminescence and antioxidative blood activity in patients with rectum cancer in radiotherapy, 15:3739 (RA;SU;In Russian)

Computer Calculations
Clinical experience of application of automated radiotherapy with the use of optimized computer programs, 15:3670 (RA;SU;In Russian)
Computerized Tomography
Potentialities of Simulix-Simtomix complex use for preradiation preparation of patients with lung cancer, 15:3647 (RA;SU;In Russian)
Dose-Response Relationships
Research in photon irradiation dose fields forming by wedge-shaped filters, 15:3673 (RA;SU;In Russian)
Early Radiation Effects
Modification of radiotherapy of patients with 1A-3A stage lymphogranulomatosis, 15:3646 (RA;SU;In Russian)
Fistulae
Conservative and surgical treatment of rectovaginal fistulas induced by irradiation, 15:3737 (RA;SU;In Russian)
Fractionated Irradiation
15-th experience on application of non-standard dose fractionating in radiotherapy of patients with lung carcinoma, 15:3648 (RA;SU;In Russian)
Efficiency of larynx cancer radiotherapy in dose multifractionating, 15:3637 (RA;SU;In Russian)
Individualization of preoperative radiotherapy in esophagus cancer, 15:3644 (RA;SU;In Russian)
Homeostasis
Thymaline as a factor of homeostasis correction in the process of radiotherapy, 15:3652 (RA;SU;In Russian)
Images
Potentialities of Simulix-Simtomix complex use for preradiation preparation of patients with lung cancer, 15:3647 (RA;SU;In Russian)
Iodine 131
Radionuclidetherapy of metastases of thyroid cancer to lungs, 15:3641 (RA;SU;In Russian)
Irradiation Procedures
Comparative evaluation of efficiency of two methods of preoperative radiotherapy of patients with lung carcinoma, 15:3656 (RA;SU;In Russian)
Isodose Curves
Program of accelerated plotting the isodose distribution in computer planning of gamma therapy of malignant tumors, 15:3671 (RA;SU;In Russian)
Meetings
Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports, 15:3625 (R;SU;In Russian)
Metastases
Radiation injuries following repeated irradiation by mean dose fractionating of multiple bone metastases of breast cancer, 15:3740 (RA;SU;In Russian)
Neoplasms
Mathematical model for evaluation of delayed injuries of rectum in radiotherapy, 15:3738 (RA;SU;In Russian)
Peculiarities of surgical treatment of patients with radiation injuries, 15:3661 (RA;SU;In Russian)
Program of accelerated plotting the isodose distribution in computer planning of gamma therapy of malignant tumors, 15:3671 (RA;SU;In Russian)
Optimization
Assessment of time of programmed irradiation in the case of malignant tumors, 15:3672 (RA;SU;In Russian)
Positron Computed Tomography
Antigen-specific composition and in-vivo methods for detecting and localizing an antigenic site and for radiotherapy, 15:3682 (P;US)
Programming
Clinical experience of application of automated radiotherapy with the use of optimized computer programs, 15:3670 (RA;SU;In Russian)
Radiation Injuries
Local complications of radiotherapy in macrofractionated irradiation of patients with larynx cancer, 15:3664 (RA;SU;In Russian)
Local radiation injuries, 15:3736 (RA;SU;In Russian)
Local radiation injuries after radiotherapy on radical program in patients with locally disseminated lung carcinoma subjected to exploratory thorocotomy, 15:3743 (RA;SU;In Russian)
Methods of prophylaxis of local radiation injuries based on use of radiobiological models, 15:3660 (RA;SU;In Russian)
Side Effects
Chemoluminescence and antioxidative blood activity in patients with rectum cancer in radiotherapy, 15:3739 (RA;SU;In Russian)
Conservative and surgical treatment of rectovaginal fistulas induced by irradiation, 15:3737 (RA;SU;In Russian)
Influence of local UHF-hyperthermia on frequency of postradiation larynx chondroperichondrites, 15:3659 (RA;SU;In Russian)
Injuries of healthy tissues in nontraditional regimen of dose fractionating in patients with cervix uteri carcinoma, 15:3662 (RA;SU;In Russian)
Local complications of radiotherapy in macrofractionated irradiation of patients with larynx cancer, 15:3664 (RA;SU;In Russian)
Local radiation injuries, 15:3736 (RA;SU;In Russian)
Mathematical model for evaluation of delayed injuries of rectum in radiotherapy, 15:3738 (RA;SU;In Russian)
Methods of prophylaxis of local radiation injuries based on use of radiobiological models, 15:3660 (RA;SU;In Russian)
Peculiarities of surgical treatment of patients with radiation injuries, 15:3661 (RA;SU;In Russian)
Radiation response in patients with pulmonary carcinoma during remote gamma therapy by means of dynamic multifractionating, 15:3642 (RA;SU;In Russian)
RADIOTHORIUM
See THORIUM 228
RADIUM
Monitoring and modeling for radon entry into basements: A status report for the small structures project, 15:2691 (R;US)
RADIUM 223
Results of the radiological survey at 133 Maywood Avenue, Maywood, New Jersey (MJ025), 15:3510 (R;US)
RADIUM 226
Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)
Results of the independent verification of radiological remedial action at 196 East 3rd South Street, Monticello, Utah (MS00083), 15:3513 (R;US)
Results of the independent verification of radiological remedial action at 384 South 2nd East Street, Monticello, Utah (MS00084), 15:3514 (R;US)
Results of the radiological survey at 72 Sidney Stret, Lodi, New Jersey (LJ067), 15:3509 (R;US)
RADIUM 228
Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)
RADIUM D
See LEAD 210
RADON
Application of radon reduction methods (revised), 15:3484 (R;US)
Factors influencing soil as a source of indoor radon: Framework for assessing radon source potential, 15:2688 (R;US)
Indoor radon and radon-decay product measurement protocols, 15:3487 (R;US)
Testing of indoor radon-reduction techniques in central Ohio houses: Phase 1 (Winter 1987-1988). Report for October 1987-August 1988 (Final), 15:3485 (R;US)
RADON 220
Simultaneous determination of Rn-220 and Rn-222 concentrations in atmospheres by cellulose nitrate ionographic detectors, 15:3056 (R;BR;In Portuguese)
RADON 222
Cancer risk for radon exposure in a polluted environment: Progress report, March 1, 1989–February 28, 1990, 15:3413 (R;US)
Control of radon in houses, 15:2692 (R;US)

Investigation of radon entry and effectiveness of mitigation measures in seven houses in New Jersey, 15:2693 (R;US)
Lung cancer risk from inhalation of radon and other pollutants in rats: Comprehensive progress report, March 1, 1987–February 28, 1990, 15:3412 (R;US)
Monitoring and modeling for radon entry into basements: A status report for the small structures project, 15:2691 (R;US)
Navy Radon Assessment and Mitigation Program progress report, September 1988–May 1989, 15:2673 (R;US)
Northwest Residential Radon Standard: Volume 1, Project report, 15:2668 (R;US)
Radon monitoring results from BPA's Residential Weatherization Program: Report No. 10, 15:2665 (R;US)
Radon monitoring results from BPS's Residential Conservation Programs: Report No. 11, 15:2667 (R;US)
Simultaneous determination of Rn-220 and Rn-222 concentrations in atmospheres by cellulose nitrate ionographic detectors, 15:3056 (R;BR;In Portuguese)
The microdosimetry of radon decay products in the respiratory tract, 15:3748 (R;US)

RAILGUN ACCELERATORS
Performance characteristics of a three-stage railgun, 15:3220 (R;US)

RAIN WATER
Measurements of environmental radiations and radioactivities in Toki, 5, 15:3476 (R;JP;In Japanese)
Measurements of environmental radiations and radioactivities in Toki, 6, 15:3477 (R;JP;In Japanese)

RAMJET ENGINES
Research and technology plans for FY 1989 and accomplishments for FY 1988, 15:2977 (R;US)

RARE EARTH COMPLEXES
Addition compounds between trifluoromethanessulfonates and N,N-Dimethylacetamide (DMA), 15:3045 (R;BR;In Portuguese)

RARE EARTH COMPOUNDS
See also DYSPROSIUM COMPOUNDS
HOLMIUM COMPOUNDS
LANTHANUM COMPOUNDS
Solubility and superconductivity in $RE(Ba_{2-x}RE_x)Cu_3O_{7+\delta}$ (RE = Nd, Sm, Eu, Gd, Dy), 15:4250 (R;US)

RARE EARTHS
See also CERIUM
DYSPROSIUM
EUROPIUM
GADOLINIUM
NEODYMIUM
SAMARIUM
TERBIUM
A review of the literature on the toxicity of rare-earth metals as it pertains to the Engineering Demonstration System surrogate testing, 15:3792 (R;US)
Bounding dispersion analysis for rare-earth elements as it pertains to the Engineering Demonstration System surrogate testing, 15:3752 (R;US)
Environmental considerations for the conduct of surrogate tests in the Engineering Demonstration System, 15:3791 (R;US)
Some aspects of analytic control used in separation process of rare earths, 15:3049 (R;BR;In Portuguese)

RATS
Analysis of cell lineage during early mouse embryogenesis, 15:3683 (BA;US)
Enhanced acoustic startle responding in rats with radiation-induced hippocampal granule cell hypoplasia, 15:3692 (R;US)
Radiation quality and rat motor performance, 15:3691 (R;US)

RBE
DNA damage in mammalian cells following heavy-ion irradiation, 15:3745 (R;US)
Methods of increasing of radiation action effectiveness in treatment of oncological diseases. V. 2. Summaries of reports, 15:3625 (R;SU;In Russian)

REACTOR ACCIDENTS
See also FUEL ELEMENT FAILURE
LOSS OF COOLANT
MELTDOWN
REACTOR CORE DISRUPTION
Comparisons of two-phase microgravity calculations using current and new flow regime maps in RELAP5, 15:3209 (J;US)
Measures for reduction of severe accident consequences: Comprehensive evaluation of the results sponsored by the BMI, 15:2495 (R;DE;In German)
Nuclear reactor accidents: Chernobyl, TMI (Three Mile Island), and Windscale. January 1974-September 1989 (Citations from Pollution Abstracts). Report for January 1974-September 1989, 15:2554 (R;US)
Studies of potential severe accidents in Finnish nuclear power plants. Quarterly report 3. quarter 1987, 15:2450 (R;FI)
Trend and pattern analysis of operational data through cooperation between OECD countries, 15:2498 (R;FR)
Uncertainty analyses for the atmospheric dispersion submodule of UFOMOD with emphasis on parameter correlations, 15:3481 (R;DE)
[Environmental transport and health effects of radioactive materials]: Foreign trip report, September 16, 1989–October 7, 1989, 15:3747 (R;US)

REACTOR COMPONENTS
See also BREEDING BLANKETS
FUEL ELEMENTS
REACTOR COOLING SYSTEMS
REACTOR CORES
Critical time step estimation for three-dimensional explicit impact analysis, 15:2508 (R;US)
Embrittlement of cast stainless steels in LWR systems, 15:2513 (R;US)

REACTOR CONTROL SYSTEMS
Human factors survey of advanced instrumentation and controls, 15:2437 (R;US)
Where to from here? Future applications of mental models of complex performance, 15:2480 (R;US)

REACTOR CONTROL THEORY
See REACTOR KINETICS

REACTOR COOLING SYSTEMS
Aging assessment of auxiliary feedwater systems, 15:2511 (R;US)
Calculated performance of a "hot-patch" for steady state post dryout experiments, 15:3186 (R;GB)

REACTOR CORE DISRUPTION
Maanshan T_pS_LB accident analysis, 15:2559 (J;US)

REACTOR CORES
Determination of the protection set-points lines for the Angra-1 reactor core, 15:2441 (R;BR;In Portuguese)

REACTOR DECOMMISSIONING
Nuclear power plant decommissioning. January 1972-September 1989 (Citations from the NTIS data base). Report for January 1972-September 1989, 15:2469 (R;US)
Recent decommissioning experiments - a literature survey. Quarterly report 3. quarter 1987, 15:2436 (R;FI;In Finnish)

REACTOR DISMANTLING
Development of a technique for dismantling geometric complicated and thick components of closed down nuclear power plants with the principle of arc-waterjet cutting. Final report, 15:2532 (R;DE;In German)

REACTOR FUEL ELEMENTS
See FUEL ELEMENTS

REACTOR FUELS
See NUCLEAR FUELS

REACTOR KINETICS
BWR plant dynamic analysis code BWRDYN user's manual, 15:2439 (R;JP;In Japanese)

REACTOR MAINTENANCE
Development of methods for the evaluation and reduction of risk factors for the maintenance of nuclear power plants, 15:2435 (R;DE;In German)

REACTOR MATERIALS
See also NUCLEAR FUELS
A computer-controlled automated test system for fatigue and fracture testing, 15:3215 (R;US)

Tensile and impact testing of an HFBR [High Flux Beam Reactor] control rod follower, 15:2457 (R;US)
[Graphite and carbon/carbon composition]: Foreign trip report, September 17, 1988–September 28, 1988, 15:2979 (R;US)

REACTOR MONITORING SYSTEMS
Incorporating fuzzy data and logical relations in the design of expert systems for nuclear reactors, 15:2483 (BA;US)
Prolgraf-B: A knowledge-based system for the automated construction of nuclear plant diagnostic models, 15:2484 (BA;US)

REACTOR OPERATION
Success/simplicity/safety/savings: SI/trip reduction at Indian point 2, 15:2558 (J;US)
Trend and pattern analysis of operational data through cooperation between OECD countries, 15:2498 (R;FR)

REACTOR OPERATORS
Model for measuring complex performance in an aviation environment, 15:3127 (R;US)
Preparing a self-evaluation report for training program accreditation, 15:2460 (R;US)

REACTOR SAFETY
International cooperation for operating safety, 15:2497 (R;FR;In French)
Maanshan T_pS_LB accident analysis, 15:2559 (J;US)
Matrix isolation-infrared and mass spectrometric studies of high-temperature molecules, 15:3039 (R;GB)
Radiation-related impacts for nuclear plant physical modifications: Final report, 15:2543 (R;US)
[Environmental transport and health effects of radioactive materials]: Foreign trip report, September 16, 1989–October 7, 1989, 15:3747 (R;US)

REACTOR SIMULATORS
Horizontal cold source friction losses of D_2 model with separate tubes comparison of calculated values to experimental results in D_2, 15:2473 (TG;US)
Horizontal cold source: Fluid dynamics tests on the moderator model in water and air current, 15:2472 (TG;US)

REACTOR VESSELS
Power reactor embrittlement data base, 15:2510 (R;US)

READOUT SYSTEMS
Development of an electron spectrometer for the HELIOS heavy ion experiment at CERN, 15:3346 (RA;DE;In German)

RECEIVERS (SOLAR)
See SOLAR RECEIVERS

RECHARGE
Use of ground-penetrating radar to define recharge areas in the Central Sand Plain. Technical completion report, 15:3560 (R;US)

RECIPROCAL TRANSLOCATIONS
See CHROMOSOMAL ABERRATIONS

RECOMBINANT DNA
Sequence and nitrate regulation of the Arabidopsis thaliana mRNA encoding nitrate reductase, a metalloflavoprotein with three functional domains, 15:3607 (J;US)

RECORDS RETRIEVAL
See INFORMATION RETRIEVAL

RECREATIONAL AREAS
Experiences with the application of a solar boiler on a camping-site in Sint Maartenszee, Netherlands, 15:2333 (R;NL;In (In Dutch))
Installation-Restoration Program Preliminary Assessment, Naknek Recreational Camps, Alaska, 15:2718 (R;US)

RECYCLING (FUEL)
See REPROCESSING

REDUCTASES
See OXIDOREDUCTASES

REFRIGERANTS
Mobile air-conditioner refrigerant evaluation. Report for April 1988-March 1989, 15:3441 (R;US)

REFRIGERATION
Review of SC/RF refrigeration systems, 15:3129 (R;US)

REFUSE
See SOLID WASTES

REFUSE-FUELED BOILERS
Experiences of DOAS technique for flue gas measurements, 15:3467 (R;SE;In Swedish)

REGION I
See FEDERAL REGION I

REGION X
See FEDERAL REGION X

REGULATIONS
Applicable or relevant and appropriate requirements (ARARs) for radioactive mixed waste, 15:2228 (R;US)
Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report, 15:2195 (R;US)
Radioactive materials released from nuclear power plants: Annual report, 1987, 15:2540 (R;US)
Recommendations for evaluating environmental monitoring programs for alternative low-level waste facilities, 15:2231 (R;US)
Remediation of DOE hazardous waste sites: Planning and integration requirements, 15:2243 (R;US)

REINFORCED MATERIALS
Y-Si-Al-O-N glass fibers. Final report, 15:2967 (R;US)

RELATIVE BIOLOGICAL EFFECTIVENESS
See RBE

RELATIVISTIC BEAM INJECTION
Efficiency of current drive by pulsed injection of REB, 15:4335 (RA;JP)

RELATIVISTIC PLASMA
Relativistic dynamics of electrons in intense laser fields, 15:4384 (J;US)

RELEASE (FISSION PRODUCT)
See FISSION PRODUCT RELEASE

REM
See DOSE EQUIVALENTS

REMEDIAL ACTION
Remediation of DOE hazardous waste sites: Planning and integration requirements, 15:2243 (R;US)
Uncontrolled hazardous waste site cleanup programs in the US: An overview, 15:3495 (R;US)

RENEWABLE ENERGY SOURCES
See also BIOMASS
GEOTHERMAL ENERGY
HYDROELECTRIC POWER
WIND POWER
Electricity producing renewable energy technologies common costing methodology. V. 2, 15:2647 (R;GB)

REPROCESSING
Sol-gel processes. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:2222 (R;US)

REPUBLIC OF KOREA
Nuclear power technical co-operation in the Republic of Korea, 15:2617 (J;XA)

RESEARCH PROGRAMS
CRN: 1987 Progress Report, 15:4485 (R;FR;In French)
Guide for the preparation of applications for the University Research Instrumentation Program, 1990, 15:2608 (R;US)
New directions for QA in basic research: The Fermilab/DOE-CH experience, 15:4491 (R;US)
Photovoltaic energy conversion - research projects on solar energy use, 15:2293 (R;DE;In German)
Quality oversight in research and development, 15:4495 (R;US)

RESEARCH REACTORS
See also ETR REACTOR
FFTF REACTOR
GRENOBLE REACTOR
HFBR REACTOR
HFIR REACTOR
JMTR REACTOR
RINSC REACTOR
A preliminary modeling and analysis framework for severe accident analysis of high power density research reactors, 15:2528 (R;AT)

RESERVOIR ROCK
Multi-mechanistic approach to the reservoir analysis of tight blanket sands, 15:2141 (BA;US)
RESERVOIRS (WATER)
See WATER RESERVOIRS
RESIDENCES
See HOUSES
RESIDENTIAL BUILDINGS
See also APARTMENT BUILDINGS
HOUSES
Control of radon in houses, 15:2692 (R;US)
Conventional research house: Cooling characterization test results. Topical report, June-September 1987, 15:2697 (R;US)
Heating energy flexibility of dwellings, 15:2706 (R;FI;In Finnish)
Measurement of condensable vapor contribution to PM10 emissions, 15:2696 (R;US)
Northwest residential radon standard: Volume 2, Comment letters, 15:2669 (R;US)
Preliminary study to a demonstration building climatic design program in the Ivory Coast, 15:2664 (R;FR;In French)
Radon monitoring results from BPA's Residential Weatherization Program: Report No. 10, 15:2665 (R;US)
Radon monitoring results from BPS's Residential Conservation Programs: Report No. 11, 15:2667 (R;US)
Research projects in residential technology, 15:2606 (R;US)
Residential cogeneration system development. Annual interim report, February 1988-January 1989, 15:2777 (R;US)
RESIDENTIAL SECTOR
Policies and programs for promoting energy conservation in the residential sector: Lessons from five OECD [Organization for Economic Cooperation and Development] countries, 15:2622 (R;US)
Residential energy demand in the six OCED countries: Historic trends and future directions, 15:2646 (R;US)
RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES
RESINS
Immobilisation in cement of ion exchange resins arising from the purification of reagents used for the decontamination of reactor circuits. Fourth semestrial report January-June 1988, 15:2175 (R;GB)
RESONANCE
See also GIANT RESONANCE
Coulomb breakup of ^{7}Li, 15:4109 (RA;DE;In German)
Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures, 15:4082 (J;NL)
RESOURCE CONSERVATION
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report, 15:3573 (R;US)
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report, 15:3574 (R;US)
Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook, 15:2601 (R;US)
RESOURCE MANAGEMENT
Inland wetlands legislation and management. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3592 (R;US)
RESOURCE RECOVERY ACTS
Performance testing of Method 1312. QA (quality assurance) support for RCRA (Resource Conservation and Recovery Act) testing: Project report, 15:3583 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Printing and publishing, 15:2738 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Wood-treating industries, 15:2737 (R;US)
RESOURCES
See also GEOTHERMAL RESOURCES
WATER RESOURCES
Guidelines for a "good" integrated resource plan, 15:2632 (R;US)
RESPIRABLE DUSTS
See DUSTS
RESPIRATORY SYSTEM
See also LARYNX
LUNGS
Pathophysiological and disease constraints on aerosol delivery, 15:3767 (R;US)
Regional aerosol deposition in human upper airways: Annual progress report, March 1, 1989–February 28, 1990, 15:3414 (R;US)
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)
RESPIRATORY SYSTEM DISEASES
See also PNEUMOCONIOSES
Chronic exposure to ozone causes restrictive lung disease, 15:3781 (R;US)
Early detection of health hazards due to asbestos exposure. Final report, 15:3428 (R;YU)
Pathophysiological and disease constraints on aerosol delivery, 15:3767 (R;US)
REST MASS
Status of glueball mass calculations in lattice gauge theory, 15:3986 (R;US)
RETINA
Treatment of laser-induced retinal injuries. Final report, 12 February 1985-31 January 1987, 15:3797 (R;IL)
REVERSE OSMOSIS
See OSMOSIS
REVERSE-FIELD PINCH
Quality assurance and quality control for the compact physics research facility (CPRF) and ZTH experiment, 15:4431 (R;US)
Testing of a 50 kA, 50 kV current interrupter with I^2t preheating and long recovery voltage, 15:4436 (R;US)
The TITAN Reversed-Field Pinch fusion reactor study: Collection of papers, 15:4443 (R;US)
RF SYSTEMS
Applications of RF linacs to free-electron lasers and particle beams, 15:3312 (J;US)
Characteristics of plasma produced by an RF induction discharge, 15:4364 (BA;US)
Crossed-field amplifiers as RF drivers for particle beam accelerators, 15:4455 (BA;US)
Rf superconductivity research and development at Los Alamos National Laboratory, 15:3128 (R;US)
RHENIUM ALLOYS
Fundamentals of beam-solid interactions and transient thermal processing, 15:2857 (B;US)
Rhenium alloying of tungsten heavy alloys, 15:2808 (R;US)
RHENIUM OXIDES
Studies of the effect of age on the structure of polycrystalline ReO_3, 15:2918 (R;XA)
RHODE ISLAND NUCLEAR SCIENCE CENTER
See RINSC REACTOR
RHODIUM BORIDES
Superconducting properties of a single-crystal sphere of $ErRh_4B_4$, 15:2954 (J;US)
RICHLAND FFTF REACTOR
See FFTF REACTOR
RIEMANN CURVATURE TENSOR
See RIEMANN SPACE
RIEMANN GEOMETRY
See RIEMANN SPACE
RIEMANN MANIFOLDS
See RIEMANN SPACE
RIEMANN METRIC
See RIEMANN SPACE
RIEMANN SPACE
Harmonic mappings into manifolds with boundary, 15:4282 (R;XA)
RIEMANN SPHERE
See RIEMANN SPACE
RIEMANN WAVES
See SHOCK WAVES

RINGS (STORAGE)
See STORAGE RINGS
RINSC REACTOR
The conversion of the 2 MW reactor at the Rhode Island Nuclear Science Center, 15:2488 (R;US)
RISER CRACKING
See COAL LIQUEFACTION
RISK ANALYSIS
See RISK ASSESSMENT
RISK ASSESSMENT
Risk assessment is a developing science: Approaches to improve evaluation of single chemicals and chemical mixtures, 15:3779 (R;US)
Supplemental risk-assessment guidance for the Superfund program. Part 1. Guidance for Public-Health Risk Assessments. Part 2. Guidance for ecological Risk Assessments. Draft report (Final), 15:3582 (R;US)
RISOE NATIONAL LABORATORY
Meteorology and Wind Energy Department annual progress report 1 January - 31 December 1988, 15:2361 (R;DK)
RIVERS
See also COLUMBIA RIVER
Water quality criteria and management models for the tidal region of the Elbe-River, 15:3566 (R;DE;In German)
ROADS
HRIS (Highway Research Information Service) Abstracts. Volume 21, Number 4 - Winter 1988, 15:2713 (R;US)
Use of ash in highway construction: Delaware demonstration project: Final report, 15:2069 (R;US)
ROCK MECHANICS
Anisotropic yielding of rocks at high temperatures and pressures: Technical progress report No. 1, April 15, 1987–April 14, 1988, 15:2358 (R;US)
Near-surface neotectonic deformation associated with seismicity in the northeastern United States, 15:3814 (R;US)
UDEC (Universal Distinct Element Code) version ICG1.5: User's manual: Volume 2, 15:3816 (R;US)
ROCK SALT
See SALT DEPOSITS
ROCKET ENGINES
Probabilistic structural analysis methods of hot engine structures, 15:3248 (R;US)
ROCKS
See also SEDIMENTARY ROCKS
Geology and Geochronology of Abuna-Ariquemes-RO, 15:3044 (R;BR;In Spanish)
Near-surface neotectonic deformation associated with seismicity in the northeastern United States, 15:3814 (R;US)
ROCKY FLATS PLANT
Development of a hazardous materials dispersion modeling capability with application to ambient air monitoring network design: Project plan, 15:3465 (R;US)
RODS (FUEL)
See FUEL RODS
ROENTGEN EQUIVALENT MAN
See DOSE EQUIVALENTS
ROTATIONAL BAND
See ROTATIONAL STATES
ROTATIONAL STATES
Nuclear collective rotation in the SU_3 model, 2. Quantal rotation for a triaxial configuration, 15:4153 (R;JP)
Nuclear collective rotation in the SU_3 model, 3. Quantal rotation for an axially symmetric configuration, 15:4154 (R;JP)
RUBIDIUM ALLOYS
Structural properties of liquid alkali-metal–lead alloys: NaPb, KPb, RbPb, and CsPb, 15:2887 (J;US)
RUMEN
See STOMACH
RUNOFF
Inland wetlands legislation and management. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3592 (R;US)
RUTHENIUM
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 2, 15:2262 (R;US)
RUTHENIUM COMPLEXES
Electrochemistry of pentaamminruthenium (II) complexes with cyanopyridinium ions, 15:3053 (R;BR;In Portuguese)

S

S CODES
Finite difference analysis of the three dimensional flow field of a vertical axis wind turbine, 15:2391 (BA;US)
S-993 RESONANCES
See F0-975 MESONS
SAFETY (NUCLEAR)
See RADIATION PROTECTION
SAFETY (REACTOR)
See REACTOR SAFETY
SAFETY INJECTION
Success/simplicity/safety/savings: SI/trip reduction at Indian point 2, 15:2558 (J;US)
SALINE ZONE
See OIL SHALES
SALMON
Use of a fish transportation barge for increasing returns of steelhead imprinted for homing: Final report, 15:2280 (R;US)
SALT DEPOSITS
Hydrogeological, geohydraulic and geothermal studies in projected final storage sites for radioactive waste. Pt. 3. Geothermal studies. Final Report, 15:2200 (R;DE;In German)
SAMARIUM
Study for the determination of samarium, europium,terbium, dysprosium and yttrium in gadolinium oxide matrix by means of atomic absorption spectrophotometry using a graphite furnace, 15:3058 (R;BR;In Portuguese)
SANDIA LABORATORIES
Energy technologies at Sandia National Laboratories: Past, Present, Future, 15:2612 (R;US)
SANDSTONES
Rock matrix and fracture analysis of flow in western tight gas sands: 1988 annual report (Phase 4). Report for 30 December 1987-31 March 1989, 15:2146 (R;US)
The influence of texture on steady foam flow in Berea sandstone, 15:2109 (R;US)
SANITARY LANDFILLS
Methodology for developing best demonstrated available technology (BDAT) treatment standards, 15:2765 (R;US)
Performance testing of Method 1312. QA (quality assurance) support for RCRA (Resource Conservation and Recovery Act) testing: Project report, 15:3583 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)
SAPPHIRE
Laser-induced interface reactions of copper thin films on sapphire substrates, 15:2878 (J;US)
The charge state of iron ions implanted into sapphire, 15:2936 (BA;US)
SARGASSO SEA
Boundary processes in the nutrient-bearing stratum of the North Atlantic: Progress report, March 1, 1989–February 28, 1990, 15:3818 (R;US)
SATELLITES
CRRES (Combined Release and Radiation Effects Satellite) SAPCERAD Plasma Wave Experiment. Final report, 20 April 1982-30 June 1988, 15:3883 (R;US)
Space radiation environment at 840 km, 15:3881 (R;US)
SCALAR FIELDS
Double-periodic wormholes in theories with global symmetries, 15:4020 (R;JP)
SCATTERING
Direct determination of scattering time delays using the *R*-matrix propagation method, 15:3931 (J;US)

Two-centre electron scattering phase shifts calculated to higher orders using the generalized JWKB method, 15:4131 (R;XA)

SCHOOL BUILDINGS
Developmental state programm for institutional conservation: Executive summary: Final technical report, October 1, 1986–September 30, 1988, 15:2621 (R;US)
Statistical evaluation of airborne asbestos measured before, during, and after abatement, 15:3438 (R;US)

SCHOOL FACILITIES
See EDUCATIONAL FACILITIES

SCHOOL PLANT
See EDUCATIONAL FACILITIES

SCHOOLS
See EDUCATIONAL FACILITIES

SCHOTTKY BARRIER DIODES
Niobium and niobium nitride contacts on semiconducting material, 15:3233 (P;US)

SCHROEDINGER EQUATION
An energy-minimizing mesh for the Schroedinger equation, 15:4289 (J;US)
Solutions to the time-dependent three-dimensional Schroedinger equation: Atoms in intense electric fields, 15:3930 (J;US)

SCHWINGER-TOMONAGA FORMALISM
Discretized light-cone quantization: The massless and the massive Schwinger model, 15:3996 (RA;DE)

SCLERA
See EYES

SCOTLAND
See UNITED KINGDOM

SEALED SOURCES
Experience in the use of the UA-type teaching kit of sealed radioactive sources, 15:4199 (R;DD;In German)
Radiation protection measurements at a UA-type teaching kit of sealed radioactive sources, 15:4198 (R;DD;In German)

SEALS
Gas velocity measurements in purged port posting systems, 15:3124 (R;GB)

SEASONAL THERMAL ENERGY STORAGE
Pilot project for a larger solar heating system with seasonal heat storage. Further documentation of borehole storage yield and economy, 15:2352 (R;DK;In Danish)
Sunclay clay plant at Kungsbacka. Technical follow-up of the thermal storage, 15:2351 (R;SE;In Swedish)

SEASONAL VARIATIONS
Red spruce decline—Winter injury and air pollutants, 15:3427 (R;US)

SEAWATER
Dynamic aspects of radioactive contamination of marine organisms. Proceeding of the 14th NIRS seminar on environmental research, 15:3570 (R;JP;In Japanese)
Effects of environmental variables on fatigue crack growth rate in steel immersed in seawater, 15:2826 (R;JP)
Final report on the investigation of water purification and waste concentration by the Vacuum Freezing Multiple Phase Transformation Process and its eutectic extension, September 1986-September 1987, 15:3572 (R;US)
Integration and optimization of the gas removal system for hybrid-cycle otec power plants, 15:2330 (BA;US)
The biocorrosion of copper by biopolymers as examined in situ, in real time FT-IR/CIR/ATR in conjunction with pre and post XPS/AES, 15:2832 (R;US)

SECONDARY BATTERIES
See ELECTRIC BATTERIES

SECURITY PERSONNEL
Analysis of physical training of security inspectors at Los Alamos National Laboratory: A preliminary report, 15:4487 (R;US)

SEDIMENT-WATER INTERFACES
Sediment-water interactions and contaminants in Corps of Engineers reservoir projects. Final report, 15:3543 (R;US)

SEDIMENTARY ROCKS
See also SANDSTONES
Hydrogeological, geohydraulic and geothermal studies in projected final storage sites for radioactive waste. Pt. 3. Geothermal studies. Final Report, 15:2200 (R;DE;In German)

SEDIMENTS
Comparison of bioassays for assessing sediment toxicity in Puget Sound. (Appendices included). Report for 1988-1989 (Final), 15:3561 (R;US)
Optically stimulated luminescence, 15:3061 (RA;DE;In German)
Thermoluminescence dating of sediments, 15:3060 (RA;DE;In German)

SEEDS
Plant senescence: Its biochemistry and physiology, 15:3601 (B;US)

SEISMIC EVENTS
See also EARTHQUAKES
Evaluation of hypotheses for the cause of the 1886 Charleston earthquake: Final report, 15:3813 (R;US)
Seismic design criteria at the Idaho National Engineering Laboratory (INEL), 15:3808 (R;US)

SEISMIC WAVES
Seismic signal modeling of the RSTN and the NORESS/ARCESS data, 15:3815 (R;US)
VSP [Vertical Seismic Profiling] and cross hole tomographic imaging for fracture characterization, 15:3812 (R;US)

SEISMOLOGY
Thermal stress and seismogenesis, 15:3809 (R;XA)

SELENIUM
Soil water and vegetation management for cleanup of selenium contaminated soils: Progress report, 15:3498 (R;US)

SELENIUM 82
Calculation of 2ν double beta decay of ^{76}Ge, ^{82}Se, $^{128,130}Te$, 15:4137 (RA;DE)
Double beta decay matrix elements in the Germanium region, 15:4133 (R;XA)

SELENIUM IONS
Direct and resonance contributions to electron-impact excitation of n=2 to n=3 transitions in neonlike ions, 15:3907 (J;US)

SELLAFIELD REPROCESSING PLANT
Investigations of iodine-129 in the natural environment: results and implications, 15:2241 (R;GB)

SEMICONDUCTOR DEVICES
See also CHARGE-COUPLED DEVICES
SEMICONDUCTOR DIODES
SEMICONDUCTOR LASERS
SEMICONDUCTOR SWITCHES
Bias and oxide thickness dependence of trapped-charge buildup in MOS (metal oxide semiconductors) devices. Technical report, 15:3222 (R;US)
Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering center programs, January-March 1989, with 1989 CEEE events calendar, 15:3133 (R;US)

SEMICONDUCTOR DIODES
See also PHOTODIODES
SCHOTTKY BARRIER DIODES
Studies of high power density, pico-second rise-time light-activated semiconductor switch. Final report, 1 September 1987-31 December 1988, 15:3223 (R;US)

SEMICONDUCTOR LASERS
Electroabsorption in single quantum-well GaAs laser structures, 15:3150 (R;US)
Low-frequency self-pulsations in asymmetric external-cavity semiconductor lasers due to multiple-feedback effects, 15:3180 (J;US)
Semiconductor quantum-well lasers and related optoelectronic devices on silicon, III-V. Technical report, 15:3145 (R;US)

SEMICONDUCTOR MATERIALS
See also P-TYPE CONDUCTORS
Optical generation of coherent surface acoustic waves: A new probe of surface dynamics and structure, 15:4238 (J;US)
Spatially resolved localized vibrational mode spectroscopy of carbon in liquid encapsulated Czochralski grown gallium arsenide wafers, 15:4233 (R;US)

SEMICONDUCTOR SWITCHES
Studies of high power density, pico-second rise-time light-activated semiconductor switch. Final report, 1 September 1987-31 December 1988, 15:3223 (R;US)

SENIOR CENTERS
See PUBLIC BUILDINGS
SEPARATION EQUIPMENT
Membrane gas separation. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3065 (R;US)
Removal of oil from oil-water mixtures using selective oil filtration. Masters thesis, 15:2132 (R;US)
SEPARATION PROCESSES
See also CHEMISORPTION
FRACTIONATION
ISOTOPE SEPARATION
REPROCESSING
Membrane gas separation. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3065 (R;US)
Membrane separation processes for liquid hydrocarbons and gases in the petrochemical industry: A technical case study, 15:2118 (R;US)
SEWAGE
See also SEWAGE SLUDGE
Water pollution: More EPA action needed to improve the quality of heavily polluted waters, 15:3547 (R;US)
SEWAGE SLUDGE
Rationalization of aerobic-thermophilic stabilisation by means of raw sludge dehydration, 15:2760 (R;DE;In German)
SHADING
Effect of shading devices on residential energy use in Austin, Texas. Research report, 15:2694 (R;US)
SHALE GAS
Multizone completion opportunities in the Appalachian basin: Final report, 15:2138 (R;US)
SHALLOW LAND BURIAL
See GROUND DISPOSAL
SHELL MODELS
An approximation for shell-model level densities, 15:4142 (RA;DE)
Systematics of neutron single particle energies for $16 \leq A \leq 50$, 15:4135 (RA;DE;In German)
SHIELDING MATERIALS
Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)
SHIPMENT
See TRANSPORT
SHIPPINGPORT PRESSURIZED WATER REACTOR
See SHIPPINGPORT REACTOR
SHIPPINGPORT REACTOR
Aging evaluation of electrical circuits using the ECCAD [Electrical Circuit Characterization and Diagnostics] system, 15:2522 (R;US)
Irradiation embrittlement of the shippingport neutron shield tank, 15:2442 (R;US)
SHOCK WAVES
Corrections for non-ideal effects in reflected shock waves at low Mach numbers, 15:3072 (R;US)
SHORT-LENS SPECTROMETERS
See MAGNETIC LENS SPECTROMETERS
SHOWER COUNTERS
Proceedings of the tau-charm factory workshop: Study of tau, charm and J/psi physics; development of high luminosity esup +esup minus rings; design of esup +esup minus detectors for tau-charm physics, 15:3962 (R;US)
SSC [Superconducting Super Collider] supplementary conceptual design report: Cryogenics for detectors, 15:3288 (R;US)
Silicon calorimetry for the SSC[Superconducting Supercollider], 15:3331 (R;US)
SI SEMICONDUCTOR DETECTORS
Si ring counters for detection of evaporation residues, 15:3340 (RA;DE;In German)
SIALON
See ALUMINIUM OXIDES
SILICON NITRIDES
SIGMA-1385 BARYONS
Radiative kaon capture at rest in hydrogen, 15:3971 (J;US)
SIGMA-1385 RESONANCES
See SIGMA-1385 BARYONS
SIGMA-MINUS ATOMS
See HADRONIC ATOMS
SILANES
Band bending and oxygen-induced defects in *a*-Si:H, 15:3007 (J;US)
SILICA
Sentinel Event Notification System for Occupational Risks (SENSOR): Recommendations for control of silica exposure at Woodbridge Sanitary Pottery Corporation, Woodbridge, New Jersey, 15:3456 (R;US)
SILICATES
See also CALCIUM SILICATES
Intra-stark relaxation of Nd^{3+} in silicate glass: Subpicosecond accumulated photon echo experiments, 15:4237 (R;US)
SILICEOUS ROCK
See SANDSTONES
SILICON
Determination of X-ray anomalous scattering in silicon, 15:4180 (R;BR;In Portuguese)
Elastic softening in nanocrystalline silicon, 15:2821 (R;US)
Electronic bonding of buried interfaces determined by soft x-ray emission spectroscopy, 15:3019 (J;US)
Free-carrier absorption from Fibonacci sequences of δ-doped layers in silicon, 15:3025 (J;US)
Interface temperatures and temperature gradients in silicon during pulsed laser irradiation, 15:2999 (BA;US)
Low temperature diffusivity for aluminum and silver in amorphous silicon, 15:2310 (BA;US)
Precipitation, phase transformation, and enhanced diffusion in ion-implanted silicon, 15:2997 (BA;US)
Recrystallization characteristics of amorphous Si, 15:2996 (BA;US)
Semiconductor quantum-well lasers and related optoelectronic devices on silicon, III-V. Technical report, 15:3145 (R;US)
Semiempirical modified embedded-atom potentials for silicon and germanium, 15:3024 (J;US)
Silicide structural evolution in high-dose cobalt-implanted Si(100) crystals, 15:3028 (J;US)
Silicon chemistry in interstellar clouds, 15:3866 (R;US)
Structure determination of the Si(111):B($\sqrt{3} \times \sqrt{3}$)*R*30° surface: Subsurface substitutional doping, 15:3006 (J;US)
Supercooling of silicon and germanium after laser melting, 15:2998 (BA;US)
Surface and bulk properties which influence ion-beam hydrogenation of silicon, 15:2852 (R;US)
Time resolved x-ray diffraction study of laser annealing in silicon at grazing incidence, 15:3017 (J;US)
Time-resolved reflectivity measurement of the pressure-enhanced crystallization rate of amorphous Si in a diamond anvil cell, 15:2995 (BA;US)
SILICON 27
Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures, 15:4082 (J;NL)
SILICON 28 REACTIONS
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)
SILICON 28 TARGET
Emission of fast protons in (e,e'p) coincidence experiments, 15:4085 (RA;DE;In German)
Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures, 15:4082 (J;NL)
Two-centre shell model description of quasi-molecular resonance states in heavy ion collisions, 15:4130 (R;XA)
SILICON ALLOYS
Characteristics of hydrogenated amorphous silicon-germanium alloys, 15:2863 (BA;US)
Enhanced oxidation of $TiSi_2$ films by As^+ implantation, 15:2990 (BA;US)
Patterson analysis of aperiodic crystals, 15:2894 (J;US)
Phase properties of the rapid cooled palladium-silicon alloy in the concentration range 40 to 58 at.% Si, 15:2851 (R;JP)

Semiempirical modified embedded-atom potentials for silicon and germanium, 15:3024 (J;US)
Structure and insulator material choices for the TITAN reversed-field-pinch reactor study, 15:4470 (BA;US)

SILICON CARBIDES
1MeV-electron irradiation induced defects in epitaxially grown 3C-SiC, 15:2920 (R;JP)
Effect of gaseous corrosion on the strength of SiC and Si_3N_4, 15:2912 (R;US)
Fracture toughness of SiC/Al metal matrix composite, 15:2973 (R;US)
High-temperature corrosion of heat exchanger materials, 15:2911 (R;US)
Interface velocity transients during melting of a-Si/c-Si thin films, 15:3000 (BA;US)
Plasma synthesis and characterization of ultrafine SiC, 15:2939 (BA;US)
Protective coating for alumina-silicon carbide whisker composites, 15:3037 (P;US)

SILICON HYDRIDES
See SILANES

SILICON NITRIDES
Effect of gaseous corrosion on the strength of SiC and Si_3N_4, 15:2912 (R;US)
High-temperature corrosion of heat exchanger materials, 15:2911 (R;US)
Pulsed laser mixing of metal overlayers on ceramics, 15:2943 (BA;US)
Sialon ceramics. January 1975-September 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-September 1989, 15:2933 (R;US)
[Ceramic powder processing]: Foreign trip report, October 7–15, 1988, 15:2930 (R;US)

SILICON OXIDES
See also SILICA
Ion beam modification of film stress and the effectiveness of thin film encapsulants on GaAs, 15:3001 (BA;US)
Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)

SILICON SEMICONDUCTOR DETECTORS
See SI SEMICONDUCTOR DETECTORS

SILICON SOLAR CELLS
22.8% efficient silicon solar cell, 15:2318 (J;US)
Low temperature diffusivity for aluminum and silver in amorphous silicon, 15:2310 (BA;US)
Lunar production of solar cells, 15:2295 (R;US)
Research on high-efficiency, single-junction, monolithic, thin-film amorphous silicon solar cells: Phase 1, Annual subcontract report, February 1, 1987–January 31, 1988, 15:2304 (R;US)
Safety considerations for high-efficiency crystalline-silicon solar cell fabrication, 15:2316 (BA;US)
Useful life prediction for first generation a-Si photovoltaic modules using outdoor test data, 15:2312 (BA;US)

SILICOSIS
See PNEUMOCONIOSES

SILOXANES
Amperometric biosensors for glucose, lactate, and glycolate based on oxidases and redox-modified siloxane polymers, 15:3600 (R;US)

SILVER
Low temperature diffusivity for aluminum and silver in amorphous silicon, 15:2310 (BA;US)
Optical waveguide formation by ion implantation of Ti or Ag, 15:2940 (BA;US)
Solid lubrication of ceramic sufraces by IAD [ion-assisted deposition]-silver coatings for heat engine applications, 15:2906 (R;US)
The bonding of acetonitrile and CH_2CN on Ag(110) determined by near edge x-ray absorption fine structure: Evidence for π-donor bonding and azimuthal ordering, 15:3090 (J;US)
Theoretical study of noble-metal (100) surface reconstructions using first-principles techniques, 15:2877 (J;US)
Thermodynamic properties of fcc transition metals as calculated with the embedded-atom method, 15:2883 (J;US)

SILVER NITRATES
The reaction of gaseous iodoethane with silver nitrate, 15:2166 (R;US)

SIMS
See MASS SPECTROSCOPY

SIMULATORS (REACTOR)
See REACTOR SIMULATORS

SINGLE CRYSTALS
See MONOCRYSTALS

SINTERING
Process monitoring using optical ultrasonic wave detection, 15:2915 (R;US)

SISTER CHROMATID EXCHANGES
Induction of sister chromatid exchanges by direct and indirect chemical agents in a human teratoma cell line, 15:3608 (R;US)

SKIN DAMAGE
See FORMATION DAMAGE

SKIN EFFECT (WELL)
See FORMATION DAMAGE

SKYRMIONS
See SOLITONS

SLABS
An S_2 synthetic acceleration scheme for the one-dimensional S_{eta} equations with linear discontinuous spatial differencing, 15:2474 (J;US)

SLATIS-SIEGBAHN SPECTROMETERS
See MAGNETIC LENS SPECTROMETERS

SLC
See STANFORD LINEAR COLLIDER

SLC DETECTORS
The digital data acquisition chain and the cosmic ray trigger system for the SLD Warm Iron Calorimeter, 15:3357 (R;US)
[Theory of elementary particle studies in weak interaction and grand unification and studies in accelerator design]: Annual progress report, 15:3330 (R;US)

SLIGHTLY ENRICHED URANIUM
[Safety related reactor physics calculation for HTGR type reactors]: Foreign trip report, October 3, 1989–October 7, 1989, 15:2455 (R;US)

SLOT OVENS
See COKE OVENS

SLUDGES
See also SEWAGE SLUDGE
Analytical methods necessary to implement risk-based criteria for chemicals in municipal sludge, 15:2775 (R;US)

SLUGS (FUEL)
See FUEL RODS

SLURRIES (FUEL)
See FUEL SLURRIES

SMALL-SCALE HYDROELECTRIC POWER PLANTS
Siphon penstock installations at hydroelectric projects: A survey of design, construction and operating experience, 15:2277 (R;US)
Small scale hydroelectric generation potential in the UK. V. 1, 15:2276 (R;GB)

SMOKES
Evaluate and characterize mechanisms controlling transport, fate, and effects of army smokes in the aerosol wind tunnel: Transport, transformations, fate, and terrestrial ecological effects of hexachloroethane obscurant smokes: Final report, 15:3463 (R;US)
Health-hazard evaluation report HETA 87-109-1950, North Riverside Fire Department, North Riverside, Illinois, 15:3458 (R;US)

SNAILS
Survey of Columbia River Basin streams for giant Columbia River spire snail Fluminicola columbiana and great Columbia River limpet Fisherola nuttalli, 15:3541 (R;US)

SNG
See HIGH BTU GAS

SODIUM
Superelastic scattering of spin-polarized electrons from sodium, 15:3909 (J;US)

The suppression of stimulated hyper-Raman emission in Na due to parametric four-wave mixing, 15:3176 (J;US)

SODIUM 23
Nuclear magnetic resonance imaging as a tool to characterize defect densities in solids, 15:4201 (R;US)

SODIUM 23 REACTIONS
Quasielastic scattering of polarized ^{23}Na, 15:4097 (RA;DE;In German)

SODIUM 24
Second class currents and the β-particle asymmetry at the decay of oriented ^{24m}Na nuclei, 15:4158 (R;SU)

SODIUM ALLOYS
Structural properties of liquid alkali-metal–lead alloys: NaPb, KPb, RbPb, and CsPb, 15:2887 (J;US)

SODIUM BROMIDES
Two-dimensional spectroscopy: Theory of nonstationary, time-dependent absorption and its application to femtosecond processes, 15:3099 (J;US)

SODIUM CHLORIDES
Nuclear magnetic resonance imaging as a tool to characterize defect densities in solids, 15:4201 (R;US)

SODIUM CITRATES
See SODIUM COMPOUNDS

SODIUM COMPOUNDS
See also SODIUM BROMIDES
SODIUM CHLORIDES
SODIUM IODIDES
SODIUM SULFATES
Ambient and high-temperature calorimetry of commercial surfactants: Project BE4A, Milestone 8, FY89 annual research plan, 15:2113 (R;US)
Selection of an effective biocide and toxicity evaluation for a specific MEOR [microbial enhanced oil recovery] microbial formulation, 15:2114 (R;US)

SODIUM IODIDES
Two-dimensional spectroscopy: Theory of nonstationary, time-dependent absorption and its application to femtosecond processes, 15:3099 (J;US)

SODIUM IONS
Trajectory analysis of low-energy and hyperthermal ions scattered from Cu(110), 15:3887 (R;US)

SODIUM LAURYL SULFATES
See SODIUM COMPOUNDS

SODIUM MINERALS
See MINERALS

SODIUM SULFATES
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)

SODIUM-SULFUR BATTERIES
Analysis of life cycle costs for electric vans with advanced battery systems, 15:2583 (B;US)
Sodium/sulfur post-test analysis at ANL, 15:2573 (R;US)

SOFT X RADIATION
Soft X-Ray amplification in laser plasmas, 15:4300 (R;FR)

SOILS
Analyses of transport in the upper soil layer and interpretation of caisson experiments, 15:2202 (R;US)
Establishment of a Ground Water Research Data Center for validation of subsurface flow and transport models. Final report, August 1986-November 1988, 15:3557 (R;US)
Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report, 15:3506 (R;DE;In German)
Liquefaction hazards and their effects on buried pipelines. Technical report, 15:3254 (R;US)
Monitoring and modeling for radon entry into basements: A status report for the small structures project, 15:2691 (R;US)
Monitoring of air pollution in the southern counties, 15:3478 (R;SE;In Swedish)
Performance testing of Method 1312. QA (quality assurance) support for RCRA (Resource Conservation and Recovery Act) testing: Project report, 15:3583 (R;US)
Soil physical properties at the Las Cruces trench site, 15:2218 (R;US)
Soil water and vegetation management for cleanup of selenium contaminated soils: Progress report, 15:3498 (R;US)
The determination of the penetrating radiation dose at Hanford, 15:4195 (R;US)

SOJA BEAN OIL
See SOYBEAN OIL

SOL-GEL PROCESS
Sol-gel processes. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:2222 (R;US)

SOLAR ABSORBERS
Plastic foil absorbers for solar collectors, 15:2345 (R;DK;In Danish)
Radiation-physical properties of selective solar absorbers, 15:2346 (R;DE;In German)

SOLAR ACTIVITY
See also SOLAR FLARES
SOLAR WIND
Galactic cosmic rays in three dimensions, 15:3865 (RA;US)
Gradients of galactic cosmic rays and anomalous components, 15:3863 (RA;US)
Solar proton event forecasts, 15:3857 (RA;US)
Time variation of galactic cosmic rays, 15:3864 (RA;US)

SOLAR BATTERIES
See SOLAR CELL ARRAYS

SOLAR CELL ARRAYS
NASA advanced space photovoltaic technology-status, potential and future mission applications, 15:2296 (R;US)

SOLAR CELL RECEIVERS
See SOLAR RECEIVERS

SOLAR CELLS
See also BACK CONTACT SOLAR CELLS
CADMIUM TELLURIDE SOLAR CELLS
CONCENTRATOR SOLAR CELLS
INDIUM PHOSPHIDE SOLAR CELLS
SILICON SOLAR CELLS
GaSb booster cells for over 30% efficient solar-cell stacks, 15:2319 (J;US)
Loss minimization through recombination center identification, 15:2301 (R;US)
NASA advanced space photovoltaic technology-status, potential and future mission applications, 15:2296 (R;US)
PC-1D version 2: Enhanced numerical solar cell modeling, 15:2311 (BA;US)
Radiation resistance of solar cells for space application, 1. Study on the irradiation procedure of electron beams, 15:2294 (R;JP;In Japanese)
Thin film cadmium telluride, zinc telluride, and mercury zinc telluride solar cells: Annual subcontract report, 1 July 1988–30 June 1989, 15:2307 (R;US)
US polycrystalline thin film solar cells program, 15:2308 (R;US)

SOLAR COLLECTORS
See also SOLAR PONDS
Development of solar collector modules, 15:2347 (R;DK;In Danish)
Heat transfer, 15:2805 (B;US)
LANSIR: An instrument for measuring the light-scattering properties of laminate membrane mirrors, 15:2350 (BA;US)

SOLAR COOLING SYSTEMS
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of September and October 1989, 15:2332 (R;US)
Effect of non-absorbable gas on the performance of a falling film absorber for open-cycle absorption solar cooling system, 15:2336 (BA;US)
Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems, 15:2340 (BA;US)
Measurement uncertainty of adsorption testing of desiccant materials, 15:2341 (BA;US)

SOLAR CORONA
Coronagraph observations and analyses of the ultraviolet solar corona. Semiannual status report, 1 April 1987-31 March 1989, 15:3868 (R;US)
SOLAR DOMESTIC WATER HEATING
See SOLAR WATER HEATING
SOLAR ENERGY CONVERSION
Photoconversion of inorganics to methane. Final topical report, October 1987-February 1989, 15:2267 (R;US)
SOLAR FLARES
Predicting the arrival times of solar particles, 15:3858 (RA;US)
Statistical study of the correlation of hard X-ray and type 3 radio bursts in solar flares, 15:3850 (R;US)
SOLAR HEATING SYSTEMS
See also PASSIVE SOLAR HEATING SYSTEMS
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of September and October 1989, 15:2332 (R;US)
Heat transfer and pressure drop measurements in an air/molten salt direct-contact heat exchanger, 15:2337 (BA;US)
SOLAR MODELS
See STAR MODELS
SOLAR NEUTRINOS
Gallium solar neutrino experiment (project 'GALLEX'), 15:3347 (RA;DE;In German)
SOLAR PARTICLES
See also SOLAR NEUTRINOS
SOLAR PROTONS
High-energy particles very near the sun, 15:3860 (RA;US)
Particles accelerated by shocks in the heliosphere, 15:3859 (RA;US)
Predicting the arrival times of solar particles, 15:3858 (RA;US)
Space radiation environment at 840 km, 15:3881 (R;US)
The radial dependence of the solar energetic particle flux, 15:3856 (RA;US)
SOLAR PONDS
Maintenance of brine transparency in salinity gradient solar ponds, 15:2349 (BA;US)
SOLAR PROTON EVENTS
See SOLAR PROTONS
SOLAR PROTONS
A new proton fluence model for E greater than 10 MeV, 15:3854 (RA;US)
Intensity/time profiles of solar particle events at one astronomical unit, 15:3855 (RA;US)
Predicting the arrival times of solar particles, 15:3858 (RA;US)
Solar proton event forecasts, 15:3857 (RA;US)
SOLAR RADIATION
See also SOLAR PARTICLES
Current models of the intensely ionizing particle environment in space, 15:3853 (RA;US)
Estimation of aerosol absorption from measurements of intensity and polarization of the sky radiation at Tsumeb (Namibia). Final report, 15:2291 (R;DE;In German)
Solar diurnal variation in the amplitude of sudden commencements of magnetic storms at the geomagnetic equator, 15:3885 (R;US)
SOLAR RECEIVERS
See also CAVITY RECEIVERS
CENTRAL RECEIVERS
Design considerations for heat-pipe solar receivers, 15:2327 (BA;US)
Internal film receiver design and systems assessment, 15:2323 (BA;US)
SOLAR SEA POWER PLANTS
See OCEAN THERMAL POWER PLANTS
SOLAR THERMAL POWER PLANTS
Thermal evaluation of advanced solar dynamic heat receiver performance. Final report, January-December 1988, 15:2320 (R;US)
SOLAR THERMAL RECEIVERS
See SOLAR RECEIVERS
SOLAR WATER HEATERS
Field survey of 259 active solar DHW systems, 15:2339 (BA;US)
SOLAR WATER HEATING
Colorado State University program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report for the months of September and October 1989, 15:2332 (R;US)
SOLAR WIND
Numerical simulation of the compressible Orszag-Tang vortex. Interim report, June 1988-February 1989, 15:3935 (R;US)
SOLID FUELS
See also MIXED OXIDE FUELS
Electricity production at fuel cell power plants, 15:3252 (R;FI;In Finnish)
Gasification of solid fuels in energy management of industry, 15:2030 (R;FI;In Finnish)
High-energy-density solid and liquid hydrocarbon fuels. Final report, July 1987-December 1988, 15:2120 (R;US)
Peat - Environment - Society. Part 2: Emissions from combustion of peat, 15:2073 (R;FI;In Finnish)
SOLID STATE LASERS
See also NEODYMIUM LASERS
SEMICONDUCTOR LASERS
Efficient nonlinear conversion of laser-diode-pumped miniature solid-state laser sources. Final report, 1 May 1986-30 April 1989, 15:3144 (R;US)
SOLID WASTES
See also MINERAL WASTES
WOOD WASTES
Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska, 15:2717 (R;US)
Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska, 15:2716 (R;US)
Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska, 15:2721 (R;US)
Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska, 15:2723 (R;US)
Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska, 15:2722 (R;US)
Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska, 15:2720 (R;US)
Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska, 15:2719 (R;US)
Installation-Restoration Program Preliminary Assessment, Naknek Recreational Camps, Alaska, 15:2718 (R;US)
Mutagenicity of combustion emissions from a biomedical-waste incinerator, 15:3774 (R;US)
SOLIDS
Development and utilization of new diagnostics for dense-phase pneumatic transport: Quarterly technical progress report, July 1, 1989–September 30, 1989, 15:2084 (R;US)
Effect of density change on rapid liquid-solid interface kinetics and heat flow, 15:3208 (BA;US)
SOLITONS
Cosmic evolution of non-topological solitons, paper 1, 15:3849 (R;US)
Gravitational radiation from primordial solitons and soliton-star binaries, 15:4292 (J;US)
SOLUTES
Analyses of transport in the upper soil layer and interpretation of caisson experiments, 15:2202 (R;US)
Effectiveness factors for hydroprocessing of coal and coal liquids: Progress report No. 8, June 15, 1989–September 15, 1989, 15:2021 (R;US)
Molecular clustering in supercritical solutions, 15:3073 (R;US)
SOLVENTS
See also ORGANIC SOLVENTS
Development of a centralized solvent recovery system at Carswell Air Force Base, 15:3801 (R;US)
Molecular clustering in supercritical solutions, 15:3073 (R;US)
Waste audit study: Automotive paint shops, 15:2744 (R;US)
SOMALIA
Jubba Environmental and Socio-economic Studies (JESS). Final report, 15:2282 (R;US)

Jubba Environmental and Socio-economic Studies (JESS). Volume 1. Executive report. Final report, 15:2283 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 2. Environmental studies. Final report, 15:2284 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 3. Socio-economic studies. Final report, 15:2285 (R;US)
Jubba Environmental and Socio-economic Studies (JESS). Volume 4. Bibliography. Final report, 15:2286 (R;US)

SONDES
See PROBES

SOOT
Enhanced flame stability and soot radiation using electric fields. Final report, July 1986-January 1989, 15:3114 (R;US)
Laser-induced-fluorescence spectroscopy of jet-cooled C_3, 15:3116 (J;US)

SOUTH KOREA
See REPUBLIC OF KOREA

SOVIET UNION
See USSR

SOY OIL
See SOYBEAN OIL

SOYBEAN OIL
Synthesis of epoxidised soya bean oil acrylate, 15:2984 (R;MY)

SOYBEANS
A county-level approach to regional resource analysis based on climate simulation, 15:3396 (J;US)

SPACE FLIGHT
Analysis of surface composition of a Martian moon with the instrument LIMA-D onboard the Mars mission PHOBOS, 15:3349 (RA;DE;In German)
CoMA, an instrument for the detailed in-situ analysis of collected cometary particulates, 15:3348 (RA;DE;In German)
Effects of iron particles on behavior and brain function: Initial studies, 15:3756 (R;US)
The effects of high energy particles on planetary missions, 15:3362 (RA;US)

SPACE HEATING
Space and hot water heating: energy-efficiency in large gas-fired systems, 15:2663 (R;GB)

SPACE HVAC SYSTEMS
Commercial building research workshop. July 30-31, 1986, 15:2145 (R;US)
Simulation of energy consumption by taking thermal comfort into account, 15:2701 (R;NO)

SPACE LATTICES
See CRYSTAL LATTICES

SPACE POWER REACTORS
Megawatt class nuclear space power systems (MCNSPS) conceptual design and evaluation report. Volume 2, technologies 1: Reactors, heat transport, integration issues. Final report, 15:2464 (R;US)
Space applications of fusion energy, 15:2493 (J;US)

SPACE VEHICLES
Antiproton powered propulsion with magnetically confined plasma engines, 15:2780 (R;US)
Design and testing of a superfluid liquid helium cooling loop, 15:3131 (R;US)
Survivable pulse power space radiator, 15:2494 (P;US)
The VISTA spacecraft: Advantages of ICF for interplanetary fusion propulsion applications, 15:4475 (BA;US)

SPACE-TIME
New spacetime superalgebras and their Kac-Moody extension, 15:4266 (R;XA)

SPACECRAFT POWER SUPPLIES
The Gevaltig: An inertial fusion powered manned spacecraft design for outer solar system missions, 15:2710 (R;US)

SPARK IGNITION ENGINES
Caterpillar 3406 spark-ignited natural-gas-engine emissions on EPA (Environmental Protection Agency) heavy-duty transient test cycle. Topical report, March-December 1988, 15:2801 (R;US)
The solitude of a determined inventor, 15:2784 (TG;US)

SPECIES DIVERSITY
Changes in ground vegetation of forest ecosystems in the middle and southern regions of the Black Forest, 15:3763 (R;DE;In German)

SPECIFIC HEAT
Modeling of heat capacities of metals, 15:2867 (J;NL)

SPECTRAL SHIFT
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)

SPECTRALLY SELECTIVE SURFACES
Radiation-physical properties of selective solar absorbers, 15:2346 (R;DE;In German)

SPECTROMETERS
See also ELECTRON SPECTROMETERS
GAMMA SPECTROMETERS
NMR SPECTROMETERS
NEUTRON SPECTROMETERS
OPTICAL SPECTROMETERS
TIME-OF-FLIGHT SPECTROMETERS
Design of a large superconducting spectrometer magnet, 15:3296 (R;JP)
In situ XRF and gamma ray spectrometer for Mars sample return mission, 15:3355 (RA;US)

SPENT FUEL CASKS
Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)

SPENT FUELS
Design and operation of gamma scan and fission gas sampling systems for characterization of irradiated commercial nuclear fuel, 15:2440 (R;US)
Shielding design for spent fuel shipping in high-capacity truck casks, 15:2194 (R;US)

SPIN GLASS STATE
Irreversibility and self-organization in spin glasses. 1. Origin of irreversibility in spin glasses, 15:4213 (R;XA)
Irreversibility and self-organization in spin glasses. 2. Irreversibility and the problem of configuration averaging, 15:4214 (R;XA)

SPIN-OFF
See TECHNOLOGY TRANSFER

SPINE
See VERTEBRAE

SPINOR FIELDS
Cubic interaction in conformal theory of integer higher-spin fields in four dimensional space-time, 15:4039 (R;XA)

SPONTANEOUS FISSION
Search for a fission fragment anisotropy signal after optical spin exchange pumping on ^{242m}Am, 15:4117 (RA;DE;In German)

SPRUCES
Red spruce decline—Winter injury and air pollutants, 15:3427 (R;US)
[Growth and physiology of red spruce in relationship to acidic deposition in the Great Smoky Mountains National Park, USA]: Foreign trip report, September 30, 1989–October 14, 1989, 15:3423 (R;US)

SQUID DEVICES
Frequency dependence of quasi-particle mixers, 15:3118 (R;US)
Inverse a-c Josephson effect at terahertz frequencies, 15:3119 (R;US)

STAINLESS STEEL-18-4-1
See STAINLESS STEELS

STAINLESS STEEL-19-9DL
See STAINLESS STEELS

STAINLESS STEEL-304
Acoustic emission during integranular stress corrosion cracking, 15:2849 (R;US)
Experience with J testing of 304/308 stainless steel weldment, 15:2833 (R;US)
Investigation of fracture toughness and fracture mechanisms using acoustic emission measurements: Progress report, 1 March 1989–28 February 1990, 15:2829 (R;US)

STAINLESS STEEL-308
Experience with J testing of 304/308 stainless steel weldment, 15:2833 (R;US)

STAINLESS STEEL-316
Chlorine related degradation of materials in coal liquefaction, 15:2018 (R;US)
STAINLESS STEELS
Ageing kinetics of CF3 cast stainless steel in the temperature range 300°C to 400°C, 15:2816 (R;GB)
Embrittlement of laboratory- and reactor-aged CF-3, CF-8, and CF-8M duplex stainless steels, 15:2825 (R;US)
Excimer laser mixing of titanium layers on AISI 304 stainless steel, 15:2866 (BA;US)
In situ ultrahigh vacuum friction measurement and wear track analysis of ion implanted 304 stainless steel, 15:2862 (BA;US)
Pretreatment and conditioning of storage ring vacuum systems, 15:3315 (R;US)
Sensitivity to hydrogen embrittlement in connection with cathodic protection of stainless duplex steels, 15:2854 (R;SE;In Swedish)
STANDARD MODEL
B physics at the Z^0 pole, 15:3966 (R;US)
Corrections to Higgs-boson-mass sum rules from the sfermion sector of a supersymmetric model, 15:4030 (J;US)
Screening of large supersymmetry breaking in low-energy physics, 15:4029 (J;US)
STANDARDIZATION
International aspects of restrictions of ozone-depleting substances, 15:3462 (R;US)
STANDING CROP
See BIOMASS
STANFORD LINEAR COLLIDER
Optimizing the average longitudinal phase of the beam in the SLC linac, 15:3276 (R;US)
STAR BURNING
Proton threshold states in ^{27}Si and the destruction of ^{26}Al at low stellar temperatures, 15:4082 (J;NL)
STAR MODELS
Nonlinear RR Lyrae models with time dependent convection, 15:3872 (BA;US)
STARK EFFECT
Electroabsorption in single quantum-well GaAs laser structures, 15:3150 (R;US)
STARS
See also BINARY STARS
VARIABLE STARS
An asteroseismology explorer, 15:3874 (BA;US)
Linear nonadiabatic pulsations of homogeneous ZAMS stars, 15:3871 (BA;US)
STATE BUILDINGS
See PUBLIC BUILDINGS
STATIC LOADS
FLAC (Fast Lagrangian Analysis of Continua) Version 2.20: Software summary: Volume 1, 15:2215 (R;US)
STATISTICAL MECHANICS
Generalization of Nose's isothermal molecular dynamics: Necessary and sufficient conditions of dynamical simulations of statistical ensembles, 15:4297 (J;US)
STEAM GENERATORS
Determination of thermodynamic data for modeling corrosion: Final report, Volume 2: Chlorides and acetates, 15:2444 (R;US)
Determination of thermodynamic data for modeling corrosion: Volume 1, Sulfates (Revision 1): Final report, 15:2443 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
STEAM INJECTION
Advanced gas-turbine steam-injection program water treatment for steam-injected gas-turbine systems. Topical report, October 1987-March 1989, 15:2417 (R;US)
STEAM TURBINES
Transportation of a 451 ton generator stator and a 234 ton generator rotor from Hartsville, TN, to Los Alamos, NM, 15:4434 (R;US)
STEARATES
Morphology of Langmuir-Blodgett multilayers: A near-total external fluorescence and reflectivity study, 15:3030 (J;US)
STEEL INDUSTRY
See METAL INDUSTRY
STEEL-000KH25
See STAINLESS STEELS
STEEL-000KH28
See STAINLESS STEELS
STEEL-00KH20N32T
See STAINLESS STEELS
STEEL-03KH13AG13
See STAINLESS STEELS
STEEL-08G2SFB
See CARBON STEELS
STEEL-0KH18G8N2T
See STAINLESS STEELS
STEEL-12KH2MV8FB
See STEELS
STEEL-12KH2V5FB
See STEELS
STEEL-ASTM-A212
Irradiation embrittlement of the shippingport neutron shield tank, 15:2442 (R;US)
STEEL-CR9MONBV
Weld simulated US Mod 9Cr 1 Mo steel: Pt. 1. General microstructure, 15:2817 (R;GB)
STEELS
See also AUSTENITIC STEELS
CARBON STEELS
Cryogenic magnet case and distributed structural materials for high-field superconducting magnets, 15:4473 (BA;US)
Effects of environmental variables on fatigue crack growth rate in steel immersed in seawater, 15:2826 (R;JP)
Engineering approaches to the application of fracture toughness data in the nuclear industry, 15:2820 (R;US)
Irradiation programs to establish the safety margins of German licensing rules related to RPV steel embrittlement, 15:2465 (R;DE)
Radiation-transport calculations of a simple structure using the vehicle code system with 69-group cross sections and the Monte Carlo neutron and photon code. Final report, 15:4178 (R;US)
Remaining-life estimation of boiler pressure parts: Volume 3, Base metal model: Final report, 15:2410 (R;US)
The consideration of irradiation embrittlement of RPV steels in German licensing rules as compared to recent results of irradiation experiments, 15:2835 (R;DE)
STELLAR BURNING
See STAR BURNING
STELLARATOR TYPE REACTORS
Blanket and shield design options for ASRA6C: A stellarator power reactor, 15:4467 (BA;US)
STELLARATORS
See also TORSATRON STELLARATOR
WENDELSTEIN-7 STELLARATOR
Basic research results on controlled thermonuclear fusion and plasma physics in the USSR between July 1987 and July 1988, 15:4400 (TG;US)
STERILE MALE TECHNIQUE
Activities of the Entomology Unit. Report No.1, 1988, 15:3687 (R;XA)
STES
See SEASONAL THERMAL ENERGY STORAGE
STIMULATED EMISSION
Lasers without inversion: Interference of lifetime-broadened resonances, 15:3152 (R;US)
Non-reciprocity of autoionizing interferences: Lasers without inversion, 15:3151 (R;US)
STOCHASTIC PROCESSES
Computational and statistical issues in discrete-event simulation. Technical report, 15:4502 (R;US)
STOKES LAW
Finite element approximations of the stokes flow problem based upon various variational principles, 15:3193 (R;BR)
STOMACH
Possibilities of stomach X-ray examination in low exposure dose, 15:3633 (RA;SU;In Russian)

STORAGE BATTERIES
See ELECTRIC BATTERIES
STORAGE BATTERIES (LEAD-ACID)
See LEAD-ACID BATTERIES
STORAGE FACILITIES
Dike insulation for LNG (liquefied natural gas) vapor mitigation. Topical report, September 1987-December 1988, 15:2154 (R;US)
STORAGE RINGS
See also BROOKHAVEN RHIC
SUPERCONDUCTING SUPER COLLIDER
Beam dynamical studies of cryring. Quarterly report 3. quarter 1987, 15:3325 (R;FI)
Collision-radiation recombination, 15:3345 (RA;DE;In German)
Crystalline beams, 15:3316 (R;US)
Filter target experiment (FILTEX), 15:3322 (RA;DE;In German)
Flux and power spectra of photon sources from bending magnets and insertion devices at a 8 GeV storage ring, 15:3324 (R;JP)
Laser cooling, 15:3294 (RA;DE;In German)
Laser-induced electron-ion interaction, 15:3889 (RA;DE;In German)
Overview of the advanced photon source, 15:3318 (R;US)
Proceedings of the tau-charm factory workshop: Study of tau, charm and J/psi physics; development of high luminosity esup +esup minus rings; design of esup +esup minus detectors for tau-charm physics, 15:3962 (R;US)
The Heidelberg heavy ion postaccelerator, 15:3289 (RA;DE;In German)
The Heidelberg heavy ion test storage ring, 15:3321 (RA;DE;In German)
Theory of elementary particles studies in weak interaction and grand unification and studies in accelerator design: Annual report, Task B, 15:3319 (R;US)
Vacuum system design for a superconducting x-ray lithography light source, 15:3314 (R;US)
STORES
See COMMERCIAL BUILDINGS
STOVER
See AGRICULTURAL WASTES
STOVES
Measurement of condensable vapor contribution to PM10 emissions, 15:2696 (R;US)
STRAIN GAGES
Development of a high temperature thin film static strain gage, 15:3367 (RA;US)
Elevated temperature strain gages, 15:3368 (RA;US)
Progress on a PdCr wire strain gage, 15:3369 (RA;US)
STRAND BREAKS
ESR studies on the mechanism of ·OH-induced strand breakage of Poly(U), 15:3730 (RA;DE)
Lung cancer risk from inhalation of radon and other pollutants in rats: Comprehensive progress report, March 1, 1987–February 28, 1990, 15:3412 (R;US)
Rate and yield of OH-induced strand break formation of polynucleotides and DNA, 15:3728 (RA;DE)
STRATEGIC DEFENSE INITIATIVE
See BALLISTIC MISSILE DEFENSE
STRATOSPHERE
Ozone and other issues in global atmospheric chemistry, 15:3394 (B;US)
STRAW
Two-step process for conversion of lignocellulose into methane, 15:2266 (R;DK)
STREAMS
See also RIVERS
Pathogenic regulation of running water macroinvertebrates: Progress report, January 1, 1989–October 15, 1989, 15:3539 (R;US)
The ecology of riparian habitats of the southern California coastal region: A community profile, 15:3538 (R;US)
STREETS
See ROADS
STRESS (BIOLOGICAL)
See BIOLOGICAL STRESS
STRESS ANALYSIS
Finite element implementation of viscoplastic models, 15:3244 (RA;US)
Mechanics of materials model, 15:3240 (RA;US)
Response characteristics of MHOST (MARC Hot-Section Technology) for 3-D inelastic analysis of hot-section components, 15:3239 (RA;US)
Three-dimensional inelastic analysis for hot section components, BEST 3D code, 15:3238 (RA;US)
Three-dimensional inelastic analysis methods for hot section components, 15:3237 (RA;US)
STRETFORD PROCESS
Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report, 15:2143 (R;US)
STRING MODELS
Estimation of the one-loop mass shifts in open superstring theory, 15:4022 (R;JP)
Half-string oscillator approach to string field theory, 15:4045 (R;GB)
Sewing relations and duality for BRST off-shell string tadpole amplitudes, 15:4009 (J;US)
String sources in 2+1-dimensional gravity, 15:4049 (J;US)
Two-point correlation function of cosmic-string loops, 15:4054 (J;US)
STRONTIUM
Lattice mode study of La_2CuO_{4-y} implanted with Sr, 15:2937 (BA;US)
STRONTIUM 90
Ingestion of radiocesium and strontium-90 by self-suppliers and non-self-suppliers in the first year following the Chernobyl reactor accident. Data taken as a basis for derivation of secondary intervention reference levels, 15:3502 (R;DE;In German)
Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report, 15:3506 (R;DE;In German)
Radionuclide deposition and exposure in the Federal Republic of Germany after the Chernobyl accident, 15:3746 (R;US)
STRONTIUM OXIDES
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)
Effects of oxygen and strontium vacancies on the superconductivity of single crystals of $Bi_2Sr_{2-x}CuO_{6-y}$, 15:2959 (J;US)
Electronic structure of $Pb_2Sr_2PrCu_3O_8$ as studied by resonant photoemission spectroscopy, 15:2956 (J;US)
Lattice defects and flux pinning in crystallized metal-oxide glasses in the Bi-Sr-Ca-Cu-O system, 15:2947 (J;US)
The effect of composition and processing on high T_c superconductors containing bismuth, 15:2909 (R;US)
Variation of T_{c0} in the 110 K superconductor $Bi_{1.5}Pb_{0.5}Ca_2Sr_2Cu_3O_x$, 15:2949 (J;US)
STRUCTURAL BEAMS
CROSS SECTION. Program description and user manual, 15:3137 (R;DK)
STRUCTURAL MATERIALS
See BUILDING MATERIALS
STRUCTURE (CRYSTAL)
See CRYSTAL STRUCTURE
STRUCTURES (BUILDINGS)
See BUILDINGS
STRUCTURES (MECHANICS)
See MECHANICAL STRUCTURES
STYRENE
In-depth industrial-hygiene survey report on styrene exposure at Fiberform, Spokane, Washington, January 16-18, 1979, 15:3433 (R;US)
In-depth industrial-hygiene survey report on styrene exposure at Larson Industries, Incorporated Boat Plant, Little Falls, Minnesota, February 27-March 1, 1979, 15:3434 (R;US)
SU-4 GROUPS
SU(4) proprerties of the Dirac equation, 15:4032 (R;BR)

SUBBITUMINOUS COAL
Development of an advanced process for drying fine coal in an inclined fluidized bed: Technical progress report for the fourth quarterly, July 1, 1989–September 30, 1989, 15:2017 (R;US)
Gas content in sealed Argonne Premium Coal Samples, 15:2051 (R;US)

SUBCRITICALITY
Subcriticality of two uranyl nitrate slab tanks spaced in air by the ^{252}CF-source-driven noise analysis method, 15:3125 (R;US)

SUBSTRATES
Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)

SUBURBS
See URBAN AREAS

SULFATES
See also AMMONIUM SULFATES
CALCIUM SULFATES
IRON SULFATES
SODIUM SULFATES
An acid rain study in the Washington, D.C. area, 15:3472 (J;US)
Participation in the MAP3S precipitation chemistry network: Progress report, August 1, 1988–July 31, 1989, 15:3410 (R;US)
Physical characteristics of study plots. Across-a-Lake States acidic-deposition gradient. Forest Service resource bulletin, 15:3455 (R;US)
The $SO^{-}{}_{4}$-induced oxidation of 1,3,6-trimethyluracil and 1,3-dimethylthymine by potassium peroxodisulphate and oxygen in aqueous solution: An interesting contrast, 15:3719 (RA;DE)

SULFIDES
See also CERIUM SULFIDES
GADOLINIUM SULFIDES
HYDROGEN SULFIDES
LANTHANUM SULFIDES
MOLYBDENUM SULFIDES
NEODYMIUM SULFIDES
TANTALUM SULFIDES
Spectroscopic analysis of orthonitrodiphenyl sulfide $C_{12}H_9NO_2S$, 15:4223 (R;BR;In Portuguese)

SULFONATES
Ambient and high-temperature calorimetry of commercial surfactants: Project BE4A, Milestone 8, FY89 annual research plan, 15:2113 (R;US)

SULFUR
Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report, 15:2143 (R;US)
Chromium modified nickel-iron aluminide useful in sulfur bearing environments, 15:2896 (P;US)
Monitoring of air pollution in the southern counties, 15:3478 (R;SE;In Swedish)
Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989, 15:3460 (R;US)
Search for the quark-gluon plasma (1989): The NA35 experiment at the CERN SPS, 15:4066 (R;US)

SULFUR 32 REACTIONS
γ-multiplicity distributions for fusion reactions at and below the barrier, 15:4095 (RA;DE;In German)
Shapes of ^{59}Cu nuclei at moderate excitation energies and spin, 15:4091 (J;US)

SULFUR 34 REACTIONS
Angular momentum dependence of the dipole giant resonance in hot nuclei, 15:4102 (RA;DE;In German)

SULFUR 35
Neutrino mass: Recent results, 15:3959 (R;US)

SULFUR 36 REACTIONS
γ-multiplicity distributions for fusion reactions at and below the barrier, 15:4095 (RA;DE;In German)

SULFUR COMPOUNDS
See also SULFATES
SULFIDES
SULFUR NITRIDES
SULFUR OXIDES
Baseline testing of the Stretford Process on the GRI 120-liter bench-scale liquid redox sulfur recovery unit. Topical report, 15:2143 (R;US)
Climate change and its effect on wet-removal processes, 15:3395 (B;US)
Production of coke with specific metallurgical properties. Analysis of conditions in the blast furnace, 15:2029 (R;DE;In German)

SULFUR DIOXIDE
1988 interorganizational workshop on future utility SO_2 emissions, 15:2078 (R;US)
Analysis of the national and regional potential for gas use in electric-utility emissions control. Topical report, December 1988, 15:2418 (R;US)
Bench-scale evaluation of calcium sorbents for acid-gas emission control. Report for October 1988-March 1989, 15:3444 (R;US)
Calcination of calcium hydroxide sorbent in the presence of SO_2 and its effect on reactivity. Report for October 1988-March 1989, 15:3443 (R;US)
Combined NO_x/SO_2 control technology, 15:2421 (R;US)
Investigations on combined deposition of particulate and gaseous pollutants in a packed bed filter at high temperatures, 15:2730 (R;DE;In German)
Maintain and operate California Air Resources Board field fumigation facility for experimental use. Final report, 17 December 1987-30 June 1989, 15:3435 (R;US)
Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989, 15:3460 (R;US)
Respiratory effects of inhaled gases and aerosols. Report for 1 November 1973-31 March 1977, 15:3787 (R;US)
Sulfur dioxide removal from flue gases by supported copper and iron absorbents: Final technical report, May 16, 1986-December 31, 1988, 15:2068 (R;US)
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 5, July 1–September 30, 1989, 15:2424 (R;US)

SULFUR HYDRIDES
See HYDROGEN SULFIDES

SULFUR NITRIDES
Electrons and phonons in polymeric sulfur nitride, 15:3034 (J;US)

SULFUR OXIDES
See also SULFUR DIOXIDE
Effect of reductive decomposition of $CaSO_4$ on sulphur capture in fluidised bed boilers, 15:3250 (R;SE)
Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 7, December 1, 1988–February 28, 1989, 15:2422 (R;US)

SULFUR SULFIDES
See SULFUR

SUPERALLOYS
See HEAT RESISTING ALLOYS

SUPERCOMPUTERS
The interesting future of supercomputing, 15:4509 (R;US)

SUPERCONDUCTING CAVITY RESONATORS
Mechanical design of SXLS [Superconducting X-ray Lithography Source] radio-frequency cavity, 15:3284 (R;US)

SUPERCONDUCTING COILS
Conceptual design report for a superconducting coil suitable for use in the large solenoid detector at the SSC [Superconducting Super Collider], 15:3333 (R;US)
Design and fabrication of the CPQ [Conductor Performance Qualification] coil, 15:4446 (R;US)

SUPERCONDUCTING FILMS
Microwave characterization of high-temperature superconductors, 15:2921 (R;US)
The initial scientific program at the NSLS infrared beamline, 15:4204 (R;US)
[Fabrication of superconducting films]: Foreign trip report, September 23, 1989–October 11, 1989, 15:2931 (R;US)

SUPERCONDUCTING JUNCTIONS
See also JOSEPHSON JUNCTIONS
Break junction measurement of the tunneling gap of a thallium-based high-temperature superconductor crystal, 15:2950 (J;US)

SUPERCONDUCTING MAGNETS
Design of a large superconducting spectrometer magnet, 15:3296 (R;JP)
Effect of twins on critical currents of high T_c superconductors. Interim report No 4, 15:3120 (R;GB)
Random errors in the magnetic field coefficients of superconducting quadrupole magnets, 15:3327 (BA;US)
Retractable gas cooled leads for ASTROMAG, 15:3130 (R;US)

SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES
See SQUID DEVICES

SUPERCONDUCTING SUPER COLLIDER
Federal research: Determination of the best qualified sites for DOE's super collider, 15:3326 (B;US)
Federal research: Determination of the best qualified sites for DOE's super collider, 15:3320 (R;US)
Random errors in the magnetic field coefficients of superconducting quadrupole magnets, 15:3327 (BA;US)

SUPERCONDUCTING WIRES
Practical superconductor development for electrical power applications: Annual report for FY 1988, 15:2432 (R;US)

SUPERCONDUCTIVITY
Review of SC/RF refrigeration systems, 15:3129 (R;US)

SUPERCONDUCTORS
A global assessment of the business impacts of high transition temperature superconducting ceramic materials on permanent magnet producers, users, and raw materials suppliers 1987–2002, 15:2917 (R;US)
Acoustic studies of new materials: Quasi crystals, low-loss glasses, and high tc superconductors. Annual summary report, 1 October 1988-30 September 1989, 15:2901 (R;US)
Application of neutron diffraction NDE to high-temperature superconducting composites, 15:3213 (R;US)
Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering center programs, January-March 1989, with 1989 CEEE events calendar, 15:3133 (R;US)
Dissipation measurement in high T_c superconductors with electromagnetic probes, 15:2916 (R;US)
Effect of twins on critical currents of high T_c superconductors. Interim report No 4, 15:3120 (R;GB)
Exchange-driven pairing of delocalized carriers in high-temperature superconductors, 15:4260 (J;US)
Gap energy and long-range order in the boson-fermion model of superconductivity, 15:4259 (J;US)
High-temperature ceramic superconductors. Annual technical report, 24 May 1988-30 June 1989, 15:2899 (R;US)
Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)
Niobium and niobium nitride contacts on semiconducting material, 15:3233 (P;US)
Physics and materials science of high-temperature superconductors. Final report, 15:3121 (R;US)
Process for single-crystal growth of high T(c) superconductors, 15:2965 (P;US)
Resistivity measurements of superconducting materials. Master's thesis, 15:2932 (R;PK)
The effect of composition and processing on high T_c superconductors containing bismuth, 15:2909 (R;US)

SUPERCRITICAL FLOW
See TURBULENT FLOW

SUPERFUND
Remedial Action
Bench-scale fixation of soils from the Tacoma Tar Pits Superfund Site. Final report, 15:3521 (R;US)
ROD (Record of Decision) annual report, FY 1988, 15:3590 (R;US)
Response to comments: Background document for the second third-land disposal restrictions proposed rule: Policy-related comments, 15:3518 (R;US)
Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report, 15:3527 (R;US)
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988, 15:3526 (R;US)
Superfund Record of Decision (EPA Region 2): Ciba-Geigy, NJ. (First Remedial Action), April 1989, 15:3530 (R;US)
Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action, 15:3591 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 3): Croyden TCE Spill, PA. (First Remedial Action), December 1988, 15:3586 (R;US)
Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989, 15:3534 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 3): Wildcat Landfill, DE. (Second Remedial Action), November 1988. Final report, 15:3535 (R;US)
Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988, 15:3533 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)
Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report, 15:3523 (R;US)
Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report, 15:3528 (R;US)
Superfund Record of Decision (EPA Region 5): Wausau Water Supply, WI. (First Remedial Action), December 1988, 15:3587 (R;US)
Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report, 15:3532 (R;US)
Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988, 15:3524 (R;US)
Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988, 15:3500 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)
Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988, 15:3529 (R;US)

Risk Assessment
Supplemental risk-assessment guidance for the Superfund program. Part 1. Guidance for Public-Health Risk Assessments. Part 2. Guidance for ecological Risk Assessments. Draft report (Final), 15:3582 (R;US)

SUPERGRAVITY
N=2 supergravity in superspace and the BRS symmetry, 15:4276 (R;XA)

SUPERLATTICES
Magnetoplasma oscillations of the wave-guided type in semiconductor superlattices, 15:4216 (R;XA)
Scaling relations for strained-layer relaxation, 15:3009 (J;US)

SUPERNOVA REMNANTS
Cosmic ray spectrum produced by supernova remnants with an upper limit on wave dissipation, 15:3824 (RA;DE;In German)
Early phase of supernova remnant evolution, 15:3822 (RA;DE;In German)

Supernovae, compact stars and nuclear physics, 15:3828 (R;US)

SUPERNOVAE
Acceleration of cosmic rays in SNR shock waves, 15:3823 (RA;DE;In German)

SUPEROXIDE RADICALS
Production of oxidative DNA damage during the metabolic activation of benzo[α]pyrene in human mammary epithelial cells correlates with cell killing, 15:3794 (J;US)

SUPERSYMMETRY
Extended local gauge invariance and the BRS symmetry in stochastic quantization of gauge fields, 15:4043 (R;JP)
Low-energy lepton violation from supersymmetric flipped SU(5), 15:4031 (J;US)
N=2 superconformal symmetry and SO(2,1) current algebra, 15:4025 (J;NL)
Screening of large supersymmetry breaking in low-energy physics, 15:4029 (J;US)

SUPERVOLTAGE RADIOTHERAPY
See RADIOTHERAPY

SURFACE CLEANING
Ultrasonic and immersion cleaning: a comparison using aqueous and fluorocarbon solvents, 15:2176 (R;GB)

SURFACE MINING
Proceedings of the conference: reclamation, a global perspective, 15:2079 (R;CA)
Special problems in the exploration and operation of loose-rock open-pit mines in developing and threshold countries, 15:2082 (RA;DE;In German)

SURFACE WATERS
See also COASTAL WATERS
LAKES
STREAMS
WATER RESERVOIRS
Environmental Radiation Data: Report 56, October-December 1988. Quarterly report, 15:3486 (R;US)
Formulation of water-quality models for streams, lakes, and reservoirs: Modeler's perspective. Final report, 15:3544 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Southern Blue Ridge Province data base, 15:3553 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Northeast data base, 15:3555 (R;US)
Quantification of Hungry Horse Reservoir water level needed to maintain or enhance reservoir fisheries: Methods and data summary, 1983–1987, 15:2278 (R;US)
Water resources data for Wisconsin, Water Year 1988. Water-data report (Annual), 1 October 1987-30 September 1988, 15:3559 (R;US)

SURFACE-ACTIVE AGENTS
See SURFACTANTS

SURFACES
See also SPECTRALLY SELECTIVE SURFACES
Coal surface control for advanced physical fine coal cleaning technologies: Quarterly report, May 1–July 31, 1989, 15:2015 (R;US)
Self-diffusion on the Lennard-Jones fcc(111) surface: Effects of temperature on dynamical corrections, 15:3093 (J;US)
Trajectory analysis of low-energy and hyperthermal ions scattered from Cu(110), 15:3887 (R;US)

SURFACTANTS
Analysis, development and investigations into phase behaviour of surfactant systems for de-oiling high-salinitiy reservoirs with reference to the Bockstedt field of Wintershall AG. Final report, 15:2110 (R;DE;In German)
Column flotation of coal with fluorosurfactants: Final report, 15:2014 (R;US)
Use of amine oxide surfactants for chemical flooding EOR [enhanced oil recovery], 15:2112 (R;US)

SURGES
Computer systems protection: Uninterruptible power supplies. January 1983-September 1989 (Citations from the Computer data base). Report for January 1983-September 1989, 15:4523 (R;US)
Lightning, surge, and transient protection. December 1982-September 1989 (Citations from the NTIS data base). Report for December 1982-September 1989, 15:2433 (R;US)

SURVEILLANCE (RADIOACTIVITY)
See RADIATION MONITORING

SURVEY (RADIOACTIVITY)
See RADIATION MONITORING

SUSPENSIONS (FUEL)
See FUEL SLURRIES

SWEDEN
Electricity supply in Sweden 1988, 15:2638 (R;SE;In Swedish)
Energy in Sweden 1988, 15:2625 (R;SE)
Evaluation of the contributions made by STU (National Swedish Board for Technical Development) to the sphere of energy. Summary and conclusions, 15:2613 (R;SE;In Swedish)
Monitoring of air pollution in the southern counties, 15:3478 (R;SE;In Swedish)

SWIRL FLOW
See VORTEX FLOW

SWITCHING CIRCUITS
A cost effective battery bank for I^2t testing and evaluation of electrical switchgear, 15:4432 (R;US)
Inductive store opening switch and tests for energy transfer to a load, 15:3140 (R;US)
Testing of a 50 kA, 50 kV current interrupter with I^2t preheating and long recovery voltage, 15:4436 (R;US)

SYMPOSIA
See MEETINGS

SYNCHROPHASOTRONS
See SYNCHROTRONS

SYNCHROTRON RADIATION
Infra-red synchrotron radiation measurements at Brookhaven, 15:3283 (R;US)

SYNCHROTRON RADIATION SOURCES
Chemical cleaning of aluminum alloy surfaces for use as vacuum materials in synchrotron light sources, 15:2818 (R;US)
Development of Fusion and Plasma Diagnostics Center - synchrotron radiation experiment, (2). Characterization of primary monochromator and construction of calibration apparatus and its application, 15:4318 (R;JP;In Japanese)
Ground motion measurements at the 1 - 2 GeV synchrotron radiation source site, 15:3299 (R;US)
The challenges of third-generation synchrotron light source, 15:3265 (R;US)
Undulator sources at a 8 GeV storage ring, 15:3323 (R;JP)

SYNCHROTRONS
See also FERMILAB TEVATRON
Overview of recent focussing horns for the BNL neutrino program, 15:3269 (BA;US)

SYNTHETIC FUELS
Biocrude suitability for petroleum refineries, 15:2269 (R;US)

SYNTHETIC FUELS REFINERIES
Cool Water Coal Gasification Program: Environmental Monitoring Plan. Volume 1-5, Section 1-12, Appendices A-F. Report for 1984-89, 15:2045 (R;US)
Cool Water Coal Gasification Program: Environmental monitoring plan. Final Report, non-proprietary. Executive summary. Report for 1984-1989, 15:2046 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1987. Report for 1 January-31 December 1987, 15:2039 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Annual report. Report for 1 April 1988-31 March 1989, 15:2043 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1986. Report for 1 January-31 March 1986, 15:2031 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: First quarter, 1987. Report for 1 January-31 March 1987, 15:2035 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1986. Report for 1 October-31 December 1986, 15:2034 (R;US)

Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1987. Report for 1 October-31 December 1987, 15:2038 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2042 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1986. Report for 1 April-30 June 1986, 15:2032 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1987. Report for 1 April-30 June 1987, 15:2036 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1988. Report for 1 April-30 June 1988, 15:2040 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Second quarter, 1989. Report for 1 April-30 June 1989, 15:2044 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1988. Report for 1 July-30 September 1988, 15:2041 (R;US)
Environmental Monitoring Plan for the Dow Syngas Project. Quarterly report: Third quarter, 1986. Report for 1 July-30 September 1986, 15:2033 (R;US)
Environmental Monitoring plan for the Dow Syngas Project. Quarterly report: Third quarter, 1987. Report for 1 July-30 September 1987, 15:2037 (R;US)
Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan quarterly report, first quarter, 1989. Report for 1 January 1989-31 March 1989, 15:2158 (R;US)
Unocal Parachute Creek Shale Oil Program. Environmental Monitoring Plan supplemental environmental data report. Volume 1. Trial trip sampling results. Report for 1 January 1988-31 March 1989, 15:2159 (R;US)
Unocal Parachute Creek shale-oil Program. Environmental Monitoring Plan quarterly report, fourth quarter, 1988. Report for 1 October-31 December 1988, 15:2157 (R;US)

SYNTHETIC LUBRICANTS
Lubricants and greases: Properties and evaluation. January 1973-April 1988 (Citations from Fluidex data base). Report for January 1973-April 1988, 15:3135 (R;US)
Lubricants and greases: Properties and evaluation. May 1988-September 1989 (Citations from Fluidex data base). Report for May 1988-September 1989, 15:3136 (R;US)

SYNTHETIC NATURAL GAS
See HIGH BTU GAS

SYNTHINE PROCESS
See FISCHER-TROPSCH SYNTHESIS

6-AMINOPURINE
See ADENINES

T

T CODES
Architecture of the ETR systems code, 15:4459 (BA;US)

T INVARIANCE
Sensitivity of the fluctuating cross-section to time-reversal violation, 15:4144 (RA;DE)
Status of time reversal invariance, 15:4018 (R;US)
Tests of time reversal invariance via transmission experiments, 15:4023 (R;US)

TACHYONS
Time of flight measurements at the pulsed proton beam, 15:4076 (RA;DE;In German)

TANDEM ELECTROSTATIC ACCELERATORS
Tandem accelerators, 15:3263 (RA;DE;In German)

TANDEM MIRRORS
See also TARA DEVICES
Cusp-stabilized mirror-based neutron source, 15:4482 (J;US)
Quasilinear diffusion modeling of the alpha-loss-cone instability in a tandem-mirror reactor, 15:4381 (J;US)

TANK FARMS
See STORAGE FACILITIES

TANTALUM
Detection of Alpher-Rubin attenuation and a search for nuclear acoustic resonance of surface waves in tantalum films, 15:2886 (J;US)
Radiation hazard from the tantalum dumps in Penang, 15:2244 (R;MY)

TANTALUM ALLOYS
Exploratory study of niobium, titanium, zirconium, and tantalum aluminides. Final report, 1 March 1988-31 May 1989, 15:2807 (R;US)

TANTALUM SULFIDES
Scanning tunneling microscopy of orthorhombic TaS_3, 15:2893 (J;US)

TAR SAND OIL
See BITUMENS

TAR SANDS
See OIL SANDS

TARA DEVICES
Operating large controlled thermonuclear fusion research facilities, 15:4458 (BA;US)

TARGET CHAMBERS
Conceptual design of a 10-MJ driver for a high gain target development facility, 15:4476 (BA;US)
Conceptual design of a high gain target development facility, 15:4477 (BA;US)
Preparation of isotopically pure ^{48}Ca-targets by ion implantation in C-foils, 15:3292 (RA;DE;In German)
Target preparation, 15:3291 (RA;DE;In German)
Wall ablation, gas dynamics, and the history of wall stresses in ICF target chambers, 15:4448 (R;US)

TATB
Fast transit gas- and condensed-phase chemistry of energetic materials, 15:3381 (R;US)

TAU LEPTONS
See TAU PARTICLES

TAU PARTICLES
Proceedings of the tau-charm factory workshop: Study of tau, charm and J/psi physics; development of high luminosity esup +esup minus rings; design of esup +esup minus detectors for tau-charm physics, 15:3962 (R;US)

TAUONS
See TAU PARTICLES

TECHNETIUM
[Immobilization of technetium in blast furnace slag]: Foreign trip report, October 13, 1989–October 30, 1989, 15:2220 (R;US)

TECHNETIUM 99
Evaluation of the ground-water contaminant plume extending from the 183-H Solar Evaporation Basins, 15:2225 (R;US)

TECHNOLOGY TRANSFER
Hostile intelligence threat: US technology, 15:2611 (R;US)
Review of facility-technology options and their development status. Final report, 15:2604 (R;US)
Technology transfer in hazardous waste management, 15:2185 (R;US)

TELLURIUM 128
Calculation of 2ν double beta decay of ^{76}Ge, ^{82}Se, $^{128,130}Te$, 15:4137 (RA;DE)

TELLURIUM 130
Calculation of 2ν double beta decay of ^{76}Ge, ^{82}Se, $^{128,130}Te$, 15:4137 (RA;DE)

TELLURIUM 130 TARGET
Angular momentum dependence of the dipole giant resonance in hot nuclei, 15:4102 (RA;DE;In German)

TELLURIUM ALLOYS
Evaluated phase diagrams of binary metal-tellurium systems of the D-block transition elements, 15:2811 (R;IN)

TEMPERATURE (TRANSITION)
See TRANSITION TEMPERATURE

TERBIUM
Study for the determination of samarium, europium,terbium, dysprosium and yttrium in gadolinium oxide matrix by means of atomic absorption spectrophotometry using a graphite furnace, 15:3058 (R;BR;In Portuguese)

TERMINAL FACILITIES
Radiological surveys of Naval facilities on Puget Sound. Final report, 15:3571 (R;US)
TERRESTRIAL BACKGROUND
See BACKGROUND RADIATION
TERRESTRIAL ECOSYSTEMS
Changes in ground vegetation of forest ecosystems in the middle and southern regions of the Black Forest, 15:3763 (R;DE;In German)
Effects of acid and lime on mesofauna of forest soils in the laboratory and in the field. Final report, 15:3762 (R;DE;In German)
TEST FACILITIES
See also TRITIUM SYSTEMS TEST ASSEMBLY
Status of the design and construction of the CPRF and the ZTH reversed field pinch experiment, 15:4360 (BA;US)
TESTING (BIOLOGICAL)
See BIOASSAY
TESTING (MATERIALS)
See MATERIALS TESTING
TETRAMETHYLTETRASELENAFULVALENE
See TMTSF
TEVATRON
See FERMILAB TEVATRON
TEXAS
Revised manual for planning, designing, and operating transitway facilities in Texas. Research report, September 1983-August 1988 (Final), 15:2711 (R;US)
TEXT EDITORS
Abstract for Zeiss editor presentation, 15:4524 (R;US)
TEXTILES
Asbestos-fiber reentrainment during vacuuming and wet cleaning of carpet at a captive research site, 15:3437 (R;US)
TFTR DEVICE
See TFTR TOKAMAK
TFTR REACTORS
See TFTR TOKAMAK
TFTR TOKAMAK
Energy confinement time and electron density profile shape in TFTR [Tokamak Fusion Test Reactor], 15:4350 (R;US)
THALLIUM
Optogalvanic spectroscopy in flames, 15:3040 (R;FR;In French)
THALLIUM 205
Nuclear magnetic resonance in molten salts, 15:4202 (R;US)
THALLIUM COMPOUNDS
See also THALLIUM OXIDES
Local atomic displacements in high T_c oxides studied by pulsed neutron scattering, 15:2905 (R;US)
THALLIUM OXIDES
Break junction measurement of the tunneling gap of a thallium-based high-temperature superconductor crystal, 15:2950 (J;US)
Microwave characterization of high-temperature superconductors, 15:2921 (R;US)
THEORETICAL DATA
Two-centre electron scattering phase shifts calculated to higher orders using the generalized JWKB method, 15:4131 (R;XA)
THERAPEUTIC AGENTS
See DRUGS
THERMAL ANALYSIS
3D thermal stress analysis of WIPP [Waste Isolation Pilot Plant] Room T RH TRU [Remote Handled Transuranic] experiments, 15:2235 (R;US)
THERMAL BARRIERS
Stabilities of dimension and thermal-resistance of ASR-ORB carbon for thermal barrier materials of HTTR, 15:2491 (R;JP;In Japanese)
THERMAL COMFORT
Preliminary study to a demonstration building climatic design program in the Ivory Coast, 15:2664 (R;FR;In French)
Simulation of energy consumption by taking thermal comfort into account, 15:2701 (R;NO)
THERMAL ENERGY STORAGE EQUIPMENT
Fuel savings in the heavy trucking industry through cool storage: Technical progress report, June 20–September 19, 1989, 15:2563 (R;US)
Operation and performance of commercial cool storage systems: Volume 2, 1988 cooling season and project summary, 15:2565 (R;US)
Thermal energy storage. July 1987-September 1989 (Citations from the NTIS data base). Report for July 1987-September 1989, 15:2566 (R;US)
THERMAL FATIGUE
Total strain version of strainrange partitioning for thermomechanical fatigue at low strains, 15:2846 (RA;US)
THERMAL FISSION
Data for decay Heat Predictions Proceedings of a specialists' meeting, 15:4121 (R;FR)
THERMAL INSULATION
Evaluation of airborne-asbestos concentrations before and during an O and M (operations and maintenance) activity: A case study, 15:3451 (R;US)
Evaluation of the thermal performance of the building envelope of existing buildings, 15:2707 (R;FI;In Finnish)
Research and technology plans for FY 1989 and accomplishments for FY 1988, 15:2977 (R;US)
THERMAL POLLUTION
Columbia River situation: A semi-technical review, 15:3548 (R;US)
THERMAL POLLUTION (AIR)
See AIR POLLUTION
THERMAL POLLUTION
THERMAL POLLUTION (WATER)
See THERMAL POLLUTION
WATER POLLUTION
THERMAL RADIATION
Numerical integration method of radiative exchange (NIMREX), 15:3113 (RA;DK)
THERMAL STORAGE
See HEAT STORAGE
THERMIONIC DIODES
Spectroscopic determination of the electrostatic potential profile in a plasma-prefilled ion diode, 15:3230 (J;US)
THERMOCOUPLES
Low cross-section Mo-Nb thermocouples for nuclear application: The state-of-the-art, 15:2831 (R;US)
THERMODYNAMIC MODEL
Study of the energetic proton production in relativistic heavy ions Ne + nuclei collisions, using Diogene detector. Hadronic matter temperature, 15:4068 (R;FR;In French)
THERMOELECTRICITY
Electrothermal guns – a theoretical investigation of factors for optimal performance. Technical report, 15:2660 (R;US)
THERMOLUMINESCENT DOSEMETERS
Light sensitivity of .13 mm thick LiF-teflon thermoluminesence dosimeters, 15:4185 (R;US)
Performance of special extremity dosemeters of BeO in fields of x and gamma radiation, 15:3335 (R;BR;In Portuguese)
THERMONUCLEAR DEVICES
See also CLOSED PLASMA DEVICES
ICF DEVICES
Measurements of environmental radiations and radioactivities in Toki, 5, 15:3476 (R;JP;In Japanese)
Neutronics issues for a laboratory microfusion facility, 15:4479 (BA;US)
THERMONUCLEAR REACTIONS
See also MUON-CATALYZED FUSION
Fracto-fusion. Mechanism of cold fusion, 15:4156 (R;JP)
THERMONUCLEAR REACTOR COOLING SYSTEMS
Heat transfer in condensation of lithium vapors, 15:4404 (R;US)
THERMONUCLEAR REACTOR MATERIALS
A semiautomated computer-interactive dynamic impact testing system, 15:4397 (R;US)
Optimization of the testing volumes with respect to neutron flux levels in the two-target high flux D-Li neutron source for the international fusion materials irradiation facility, 15:4435 (R;US)

[Graphite and carbon/carbon composition]: Foreign trip report, September 17, 1988–September 28, 1988, 15:2979 (R;US)

THERMONUCLEAR REACTOR WALLS
See also FIRST WALL
Microwave cavity studies for thermal testing of ceramic breeder materials, 15:2944 (BA;US)

THERMONUCLEAR REACTORS
See also ION BEAM FUSION REACTORS
LASER FUSION REACTORS
MAGNETIC MIRROR TYPE REACTORS
STELLARATOR TYPE REACTORS
TOKAMAK TYPE REACTORS
Accelerator and Fusion Research Division: 1988 summary of activities, 15:3259 (R;US)
Advanced fusion MHD power conversion using the CFAR [compact fusion advanced Rankine] cycle concept, 15:4444 (R;US)
Agreement between the USSR State Committee on the Use of Nuclear Power and the Department of Energy of the USA regarding joint studies in the field of controlled thermonuclear fusion and plasma physics, 15:4403 (TG;US)
Heat transfer, 15:2805 (B;US)
Microwave superheaters for fusion, 15:4464 (BA;US)
Neutronics design of self-cooled lithium blanket and shield for the high wall loading TITAN RFP reactor, 15:4466 (BA;US)
Proceedings of US-Japan workshop on new generation experiments and reactors (joined by EC), 15:4440 (R;JP)
Ripple loss of alpha particles in ITER, 15:4340 (R;JP)
Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987, 15:4416 (R;XA)

THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS

THERMOPILES
See THERMOCOUPLES

THICKNESS
Development of the method for measuring the thickness of a milled peat layer, 15:2090 (R;FI;In Finnish)

THIN FILMS
Effects of nitrogen pulsing on sputter-deposited beryllium films, 15:2855 (R;US)
Enhanced oxidation of $TiSi_2$ films by As^+ implantation, 15:2990 (BA;US)
Hybrid solar cells based on DC magnetron sputtered films of n-ITO on APMOVPE grown p-InP, 15:2317 (BA;US)
Interface velocity transients during melting of a-Si/c-Si thin films, 15:3000 (BA;US)
Ion beam modification of film stress and the effectiveness of thin film encapsulants on GaAs, 15:3001 (BA;US)
Plasma-activated ion-beam reactive sputtering of NbN thin films, 15:2898 (R;US)
Safety considerations for high-efficiency crystalline-silicon solar cell fabrication, 15:2316 (BA;US)
Surface magneto-optical studies of ultrathin ferromagnetic films, 15:2822 (R;US)

THIOETHERS
See SULFIDES

THIRRING MODEL
Thirring model on a Riemann surface, 15:4048 (J;US)

THORAX
See CHEST

THORIUM
Thorium re-improvement of residues from thorium purification plants, 15:2169 (R;BR;In Portuguese)
U, Th and K distributions inferred from regional geology and the terrestrial radiation profiles in India, 15:3505 (R;IN)

THORIUM 220
Spectroscopic investigations of the neutron-deficient nuclei ^{220}Th and ^{222}Th, 15:4116 (RA;DE;In German)

THORIUM 222
Spectroscopic investigations of the neutron-deficient nuclei ^{220}Th and ^{222}Th, 15:4116 (RA;DE;In German)

THORIUM 228
Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)

THORIUM 230
Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)

THORIUM 232
Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)
Investigation of many-phonon excitations in ^{232}Th, 15:4114 (RA;DE;In German)
Measurements of prompt fission neutron spectra and double-differential neutron inelastic-scattering cross sections for ^{238}U and ^{232}Th, 15:4119 (R;JP;In Japanese)
Results of the radiological survey at 133 Maywood Avenue, Maywood, New Jersey (MJ025), 15:3510 (R;US)
Results of the radiological survey at 72 Sidney Stret, Lodi, New Jersey (LJ067), 15:3509 (R;US)

THORIUM 232 TARGET
Heavy ion induced transfer reactions with ^{232}Th by the Crystal Ball, 15:4115 (RA;DE;In German)
Investigation of many-phonon excitations in ^{232}Th, 15:4114 (RA;DE;In German)

THORIUM ISOTOPES
See also THORIUM 220
THORIUM 222
THORIUM 228
THORIUM 230
THORIUM 232
Heavy ion induced transfer reactions with ^{232}Th by the Crystal Ball, 15:4115 (RA;DE;In German)

THORIUM NITRATES
Obtention of crystals feom thorium nitrate using microwave as heating source, 15:3103 (R;BR;In Portuguese)

THORIUM OXIDES
Program of research and development on the thorium utilization in PWRS. Final report (1979-1988), 15:2449 (R;DE)

THORON
See RADON 220

THREE MILE ISLAND-2 REACTOR
Comparison of thermal and mechanical responses of the TMI-2 reactor vessel, 15:2524 (R;US)
DOE modifications to the MAAP [Modular Accident Analysis Program] code: Volume 6, Core melt progression modeling and benchmarking WBS 3.4.8, 15:2515 (R;US)
Fission product relocation and behavior in the TMI-2 reactor vessel, 15:2486 (R;US)
Just how much water is required to cool a molten core?, 15:2519 (R;US)
Quality Assurance in the removal and transport of the TMI-2 core, 15:2523 (R;US)
TMI-2 data qualification and data bases, 15:2520 (R;US)
Verification of the ORIGEN2 code analysis for the TMI-2 reactor core, 15:2485 (R;US)

THYROID HORMONES
Quality control scheme for thyroid related hormones measured by radioimmunoassay. Final report for the period 1 January 1985 - 1 April 1989, 15:3620 (R;XA)

THYROID STIMULATING HORMONE
See TSH

TIBER-X TOKAMAK
Cryogenic magnet case and distributed structural materials for high-field superconducting magnets, 15:4473 (BA;US)
High-field superconducting solenoids for the TIBER II PF system, 15:4472 (BA;US)

TIGHT SANDS
See SANDSTONES

TIME-OF-FLIGHT MASS SPECTROMETERS
Analysis of surface composition of a Martian moon with the instrument LIMA-D onboard the Mars mission PHOBOS, 15:3349 (RA;DE;In German)

Calculations on a third order energy focusing time-of-flight mass spectrometer, 15:3352 (RA;DE;In German)
CoMA, an instrument for the detailed in-situ analysis of collected cometary particulates, 15:3348 (RA;DE;In German)
Development of a laser ion source for xenon, 15:3295 (RA;DE;In German)

TIME-OF-FLIGHT SPECTROMETERS
See also TIME-OF-FLIGHT MASS SPECTROMETERS
Low energy neutral particle energy analyser by time of flight method, 15:4420 (R;JP;In Japanese)

TIME-OF-SEASON PRICING
See SEASONAL VARIATIONS

TIME-REVERSAL INVARIANCE
See T INVARIANCE

TIN 119
Anomalous local hopping of Sn impurities in lead, 15:2881 (J;US)

TIN 120 REACTIONS
Study of multi-fragmentation in collisions of heavy ions, 15:4096 (RA;DE;In German)

TIN 120 TARGET
Deep-inelastic myon-nucleus scattering at the CERN SPS; EMC and NMC Collaboration, 15:3956 (RA;DE;In German)
Single neutron transfer reactions induced by polarized ^{7}Li ions, 15:4136 (RA;DE)
Study of multi-fragmentation in collisions of heavy ions, 15:4096 (RA;DE;In German)

TIN 124 TARGET
Systematics of the (^{18}O,^{20}Ne) reaction and the determination of the mass excess of ^{122}Cd, 15:4093 (RA;DE;In German)

TIN ISOTOPES
See also TIN 119
Neutron cross sections of tin and cadmium isotopes in the range of 0.5-2.0 MeV, 15:4098 (RA;SU;In Russian)

TISSUES
See also ANIMAL TISSUES
Comparison of digestion procedures used for the determination of boron in biological tissues by ICP-AES [inductively-coupled, plasma-atomic emission spectroscopy], 15:3609 (R;US)
Maximum entropy and equations of state for random cellular structures, 15:2969 (R;US)

TITANIUM
Excimer laser mixing of titanium layers on AISI 304 stainless steel, 15:2866 (BA;US)
Optical waveguide formation by ion implantation of Ti or Ag, 15:2940 (BA;US)

TITANIUM 48
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

TITANIUM 50
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

TITANIUM 52
Validity of the adiabatic rotational model in the case of the Hexadecupole operator, 15:4129 (R;XA)

TITANIUM ALLOYS
See also NITINOL
TITANIUM BASE ALLOYS
Electronic origin of the intermediate phase of NiTi, 15:2892 (J;US)
Enhanced oxidation of $TiSi_2$ films by As^+ implantation, 15:2990 (BA;US)
Exploratory study of niobium, titanium, zirconium, and tantalum aluminides. Final report, 1 March 1988-31 May 1989, 15:2807 (R;US)
Structure and insulator material choices for the TITAN reversed-field-pinch reactor study, 15:4470 (BA;US)
The dose, temperature, and projectile-mass dependence for irradiation-induced amorphization of CuTi, 15:2873 (J;US)
The projectile mass dependence of the amorphization process and the critical temperature in the ion irradiated CuTi, 15:2858 (BA;US)

TITANIUM BASE ALLOYS
Influence of microstructure and microdamage processes on fracture at high loading rates. Final report, 1 February 1986-30 September 1988, 15:2806 (R;US)

TITANIUM COMPOUNDS
See also TITANIUM OXIDES
Cluster-impact fusion, 15:4240 (J;US)

TITANIUM OXIDES
A cross-sectional TEM study of the effects of annealing conditions on the regrowth of lead-implanted single crystal calcium titanate, 15:2941 (BA;US)
Calculation of optical transport and localization quantities, 15:2962 (J;US)
Electron paramagnetic resonance investigations of divalent cobalt in single crystals of perovskite ($CaTiO_3$), 15:3023 (J;US)
Raman spectroscopy of nanophase TiO_2, 15:2946 (J;US)

TLD (DOSEMETERS)
See THERMOLUMINESCENT DOSEMETERS

TLD SYSTEMS
See THERMOLUMINESCENT DOSEMETERS

TMTSF
Theory of unusual anisotropy of magnetoresistance in organic superconductors, 15:3011 (J;US)

TOKAMAK DEVICES
See also ALCATOR DEVICE
ASDEX TOKAMAK
COMPACT IGNITION TOKAMAK
ITER TOKAMAK
JFT-2M TOKAMAK
TRIAM-1 TOKAMAK
VERSATOR TOKAMAK
Status of work on TSP, T-15 and other OTR units, 15:4401 (TG;US)

Ballooning Instability
Alpha modification of Tokamak ballooning instabilities, 15:4304 (R;US)

Confinement Time
Uncertainties associated with extrapolating L mode energy confinement to ITER and CIT, 15:4305 (R;US)

Current-Drive Heating
Effect of energetic particle absorption on fast wave current drive, 15:4312 (R;US)
Efficiency of current drive by pulsed injection of REB, 15:4335 (RA;JP)

Data Acquisition Systems
The MTX [Microwave Tokamak Experiment] data acquisition system, 15:4358 (R;US)

Fuel Injection Systems
Acceleration of small, light projectiles (including hydrogen isotopes) to high speeds using a two-stage light gas gun, 15:4396 (R;US)

Icr Heating
Fundamental studies of fusion plasmas: Annual performance report, 15:4307 (R;US)

Impurities
Control of ash accumulation by induced-fishbones, 15:4398 (R;US)

Joule Heating
OHMIC ignition in a single-turn-coil Tokamak (IGNITEX), 15:4457 (BA;US)

Meetings
Proceedings of the Japan-U.S. workshop P-118 on vacuum technologies for fusion devices, 15:4419 (R;JP)

Non-Inductive Current Drive
Particle simulation on high power ECH current drive, 15:4338 (RA;JP)

Pellet Injection
The ORNL plasma fueling program, 15:4388 (R;US)

Plasma Confinement
Self-consistent radial sheath, 15:4380 (J;US)

Plasma Diagnostics
MTX [Microwave Tokamak Experiment] diagnostic and auxiliary systems for confinement, transport, and plasma physics studies, 15:4352 (R;US)
Magnetic microtearing coherence in tokamak plasmas, 15:4311 (R;FR;In French)
Temperature fluctuations and transport in a tokamak edge plasma, 15:4379 (J;US)

Plasma Disruption
Computation of electromagnetic effects in a tokamak due to a plasma disruption, 15:4303 (R;US)
Plasma Instability
Stability of the Global Alfven Eigenmode in the presence of fusion alpha particles in an ignited tokamak plasma, 15:4308 (R;US)
Pressure Gradients
Study of electron density and pressure profile behavior in a tokamak plasma, 15:4351 (R;US)
Research Programs
Basic research results on controlled thermonuclear fusion and plasma physics in the USSR between July 1987 and July 1988, 15:4400 (TG;US)
Tearing Instability
Magnetic microtearing coherence in tokamak plasmas, 15:4311 (R;FR;In French)
Transport Theory
Advanced toroidal theory: Progress report, 15:4306 (R;US)
Vacuum Systems
Proceedings of the Japan-U.S. workshop P-118 on vacuum technologies for fusion devices, 15:4419 (R;JP)

TOKAMAK FUSION TEST REACTOR
See TFTR TOKAMAK

TOKAMAK TYPE REACTORS
See also COMPACT IGNITION TOKAMAK
DOUBLET REACTORS
JET TOKAMAK
JT-60 TOKAMAK
TFTR TOKAMAK
TIBER-X TOKAMAK
CPRF/ZTH shell poloidal gap design and fabrication, 15:4460 (BA;US)
Divertor design for the TITAN reversed-field-pinch reactor, 15:4469 (BA;US)
Economic comparison of fusion fuel cycles, 15:4462 (BA;US)
Structure and insulator material choices for the TITAN reversed-field-pinch reactor study, 15:4470 (BA;US)
The TITAN oscillating-field current-drive system, 15:4463 (BA;US)
Thermal-hydraulic design for the lithium-cooled TITAN reversed-field-pinch reactor, 15:4468 (BA;US)

TOLUENE
Upgrading of light Fischer-Tropsch products: Quarterly report No. 6, January 1, 1988–March 31, 1988, 15:2264 (R;US)

TOLUIDINES
Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)

TOLYLAMINES
See TOLUIDINES

TORSATRON STELLARATOR
See also ATF TORSATRON
Design of the Compact Auburn Torsatron: [Annual performance report], 15:4399 (R;US)

TOTAL ENERGY SYSTEMS
Cogeneration- and Total Energy potentials at an alternative natural gas price policy and environmental policy in the Dutch National Energy Outlook scenarios, 15:2619 (B;NL;In (In Dutch))
Improved operational performance of the Shenandoah Solar Total Energy Project, 15:2325 (BA;US)

TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS

TOXIC MATERIALS
See also TOXINS
Air Pollution
Information on substances for review as toxic air contaminants. Summary report, January 1984-February 1989 (Final), 15:3430 (R;US)
Air Pollution Control
Air toxics control situation room. Report for July 1988-March 1989, 15:3450 (R;US)
Air Pollution Monitoring
Evaluation of emission sources from creosote wood-treatment operations. Final report, 15:2747 (R;US)
Air Quality
Beryllium dispersion near explosive firing tables: A comparison of computed and observed results, 15:3468 (R;US)
Bioassay
Comparison of bioassays for assessing sediment toxicity in Puget Sound. (Appendices included). Report for 1988-1989 (Final), 15:3561 (R;US)
Biological Accumulation
Accumulation patterns of heavy metals and chlorinated hydrocarbons by sea otters, Enhydra lutris, in California. Final report, 15:3788 (R;US)
Carcinogens
Genetic activity profiles: Use in management of risk from genotoxic substances in the environment, 15:3766 (R;US)
Catalogs
Hints and search strategies for the substances listed in the Accident Ordinance, 15:3803 (R;DE;In German)
Data Base Management
Registry of Toxic Effects of Chemical Substances (RTECS), 1988 computer tape. Data file, 15:3790 (R;US)
Forecasting
Beryllium dispersion near explosive firing tables: A comparison of computed and observed results, 15:3468 (R;US)
Health Hazards
Air toxics control situation room. Report for July 1988-March 1989, 15:3450 (R;US)
Methods used in the United States for the assessment and management of health risk due to chemicals, 15:3773 (R;US)
Information Dissemination
Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication, 15:3684 (R;US)
Mutagenesis
Pilot investigation of indoor-outdoor and personal PM10 (thoracic) and associated ionic compounds and mutagenic activity. Final report, February 1987-April 1989, 15:3447 (R;US)
Mutagens
Genetic activity profiles: Use in management of risk from genotoxic substances in the environment, 15:3766 (R;US)
Respiration
Pathophysiological and disease constraints on aerosol delivery, 15:3767 (R;US)
Risk Assessment
Assessment of ecologic risks related to chemical exposure: Methods and strategies used in the United States, 15:3772 (R;US)
Genetic-activity profiles and hazard assessment, 15:3768 (R;US)
Waste Disposal
Analytical methods necessary to implement risk-based criteria for chemicals in municipal sludge, 15:2775 (R;US)
Application of a simple short-term bioassay for the identification of genotoxins from hazardous wastes, 15:3782 (R;US)
Water Pollution
Methods for aquatic toxicity-identification evaluations. Phase 2. Toxicity identification procedures. Technical report, 15:3550 (R;US)
Methods for aquatic toxicity-identification evaluations. Phase 3. Toxicity confirmation procedures. Technical report, 15:3549 (R;US)
Water Pollution Control
Structural properties for determining mechanisms of toxic action, 15:3778 (R;US)

TOXICITY
Attempted use of zinc in vivo to protect against nitrogen mustard toxicity in tumor-free and in L1210 leukemia-bearing $B6D2F_1$ mice, 15:3764 (R;US)
Detection of genetic hazards from environmental chemicals with plant test systems, 15:3776 (R;US)
Electrophysiological systems for neurotoxicity field testing: PEARL II and alternatives, 15:3780 (R;US)
Environmental considerations for the conduct of surrogate tests in the Engineering Demonstration System, 15:3791 (R;US)

Genetic-activity profiles and hazard assessment, 15:3768 (R;US)
Methods for aquatic toxicity-identification evaluations. Phase 2. Toxicity identification procedures. Technical report, 15:3550 (R;US)
Use of genotoxic activity profiles in assessment of carcinogenesis and transmissible genetic effects, 15:3775 (R;US)
Utility of short-term tests for genetic toxicity, 15:3612 (R;US)

TOXINS
Electrophysiological systems for neurotoxicity field testing: PEARL II and alternatives, 15:3780 (R;US)

TRADE
Convention on international trade in endangered species of wild fauna and flora. 1987 annual report. Final report, 15:3613 (R;US)
International aspects of restrictions of ozone-depleting substances, 15:3462 (R;US)

TRANSFER (HEAT)
See HEAT TRANSFER

TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION

TRANSFER (IN ORGANISM)
See RADIONUCLIDE KINETICS

TRANSFER (MASS)
See MASS TRANSFER

TRANSFER REACTIONS
Workshop for cascade project, physics using large acceptance spectrograph and its technical considerations, 15:4069 (R;JP;In Japanese)

TRANSFORMERS
Computer controlled MHD power consolidation and pulse-generation system: Technical progress report, October 1988–March 1989, 15:2648 (R;US)
Large signal nonlinear model of anisotropic transformers for nonsinusoidal operation: Final report, July 1, 1986–March 30, 1989, 15:3225 (R;US)

TRANSIENTS
See also ELECTRICAL TRANSIENTS
Multiloop integral system test (MIST): Test Group 32, SBLOCA [small-break loss-of-coolant accidents] with altered leak and HPI [high-pressure injection] configurations: Final report: Volume 4, 15:2547 (R;US)

TRANSITION ELEMENTS
See also CHROMIUM
COBALT
COPPER
GOLD
IRON
MANGANESE
MOLYBDENUM
NICKEL
NIOBIUM
SILVER
TANTALUM
TECHNETIUM
TITANIUM
TUNGSTEN
VANADIUM
YTTRIUM
First-principles interatomic potentials in transition metals: Multi-ion interactions and their analytic representation, 15:4236 (R;US)

TRANSITION METALS
See TRANSITION ELEMENTS

TRANSITION TEMPERATURE
Linear electron-hole-electron pair model of high-temperature superconductivity in $La_{2-x}M_xCuO_4$ and $YBa_2Cu_3O_{7-y}$: 2, Dependence of the superconducting transition temperatures on pressure and on hole concentration, 15:4251 (R;US)

TRANSMISSION (HEAT)
See HEAT TRANSFER

TRANSPORT
See also HYDRAULIC TRANSPORT
WASTE TRANSPORTATION
Assessment of costs and benefits of flexible and alternative fuel use in the US transportation sector: Technical report three: Methanol production and transportation costs, 15:2618 (R;US)

TRANSPORT (GAMMA)
See PHOTON TRANSPORT

TRANSPORT (IN ORGANISMS)
See RADIONUCLIDE KINETICS

TRANSPORT (NEUTRON)
See NEUTRON TRANSPORT

TRANSPORT (PHOTON)
See PHOTON TRANSPORT

TRANSPORT (RADIATION)
See RADIATION TRANSPORT

TRANSPORTATION SECTOR
Ceramics for transportation engines - siren or solution, 15:2782 (R;US)
The slowdown of 1989–90: Further evidence for the use of transportation sector indicators to predict GNP growth, 15:2591 (R;US)

TRANSPORTATION SYSTEMS
See also MASS TRANSIT SYSTEMS
Urban Transportation Abstracts. Volume 7, 1988. Report for September 1988-February 1989, 15:2712 (R;US)

TRANSURANIUM WASTES
See ALPHA-BEARING WASTES

TREES
See also FIRS
PINES
SPRUCES
Microcomputer Scientific Software Series 5: The Biomass User's Manual. Forest Service general technical report, 15:2298 (R;US)

TRIAM-1 TOKAMAK
Steady state current drive by lower hybrid wave in TRIAM-1M, 15:4418 (RA;JP)

TRIBOLOGY
Computer-controlled test system for operating different wear-test machines, 15:3216 (R;US)
The modeling of wear in energy conversion and utilization technologies: Proceedings, 15:3214 (R;US)

TRICHLOROMETHANE
See CHLOROFORM

TRIPLET PARTICLES
See QUARKS

TRITIATED COMPOUNDS
See TRITIUM COMPOUNDS

TRITIUM
Atmospheric detritiation system performance, 15:4406 (R;US)
Development and application of an on-line tritium production rate measuring method, 15:4421 (R;JP)
Interpretation of recent LAMPF results on D T MU formation, 15:4073 (R;US)
Management of tritium wastes in the United Kingdom. A survey of present and future arisings, review of possible disposal options and areas where further R and D may be needed to develop a management strategy for the future, 15:2179 (R;GB)
Model for calculating room air and surface tritium concentrations, 15:3480 (R;GB)
Neutrino mass: Recent results, 15:3959 (R;US)

TRITIUM COMPOUNDS
HTO deposition through gas exchange between soil and atmosphere, 15:3507 (R;DE;In German)

TRITIUM SYSTEMS TEST ASSEMBLY
The Breeding Blanket Interface (BBI) and the Tritium Systems Test Assembly (TSTA), 15:4393 (R;US)

TRITIUM TARGET
Muon spectrum and convoy effects after muon-catalyzed fusion, 15:4177 (J;US)

TROPOSPHERE
Atmospheric depositional characteristics of Beryllium 7 and Lead 210 along Southeastern Virginia coast, 15:3490 (J;US)
Global tropospheric chemistry: Chemical fluxes in the global atmosphere, 15:3393 (R;US)

Ozone and other issues in global atmospheric chemistry, 15:3394 (B;US)
Tropospheric nitric oxide measurements, 15:3418 (RA;US)

TRU WASTES
See ALPHA-BEARING WASTES

TRX-1
See REVERSE-FIELD PINCH

TSH
Quality control scheme for thyroid related hormones measured by radioimmunoassay. Final report for the period 1 January 1985 - 1 April 1989, 15:3620 (R;XA)

TSTA
See TRITIUM SYSTEMS TEST ASSEMBLY

TUBES
Comparison of photodesorption yields from aluminum stainless and Cu-plated beam tubes, 15:3285 (R;US)
Multiloop integral system test (MIST): Test Group 34, Steam generator tube rupture: Final report: Volume 6, 15:2548 (R;US)
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)

TUBES (CONDUITS)
See PIPES

TUFF
A sensitivity study of near-field thermomechanical conditions in tuff, 15:2227 (R;US)
Predicting flow through low-permeability, partially saturated, fractured rock: A review of modeling and experimental efforts at Yucca Mountain, 15:2234 (R;US)

TUMOR CELLS
Induction of sister chromatid exchanges by direct and indirect chemical agents in a human teratoma cell line, 15:3608 (R;US)

TUMORS
See NEOPLASMS

TUNGSTEN
Tungsten and tungsten-alloy powder metallurgy: Powder production and applications-excluding lamps. November 1971-July 1989 (Citations from the US Patent data base). Report for November 1971-July 1989, 15:2847 (R;US)

TUNGSTEN 184 TARGET
High energetic photons from heavy ion collisions, 15:4105 (RA;DE;In German)

TUNGSTEN ALLOYS
See also TUNGSTEN BASE ALLOYS
TUNGSTEN BRONZE
Formation of metastable structures and amorphous phases in Cu-W alloys using the triode sputtering technique, 15:2860 (BA;US)
Rhenium alloying of tungsten heavy alloys, 15:2808 (R;US)

TUNGSTEN BASE ALLOYS
Strain aging in tungsten-heavy alloys. Final report, 15:2810 (R;US)
Tungsten and tungsten-alloy powder metallurgy: Powder production and applications-excluding lamps. November 1971-July 1989 (Citations from the US Patent data base). Report for November 1971-July 1989, 15:2847 (R;US)

TUNGSTEN BRONZE
Growth of tungsten bronze family crystals. Final technical report, 6 May 1985-30 November 1988, 15:2809 (R;US)

TUNGSTEN CARBIDES
Tungsten and tungsten-alloy powder metallurgy: Powder production and applications-excluding lamps. November 1971-July 1989 (Citations from the US Patent data base). Report for November 1971-July 1989, 15:2847 (R;US)

TURBINE BLADES
Air Flow
Experimental investigations of the rotor loads and the rotor-induced flow of a two-bladed wind turbine model in the low speed wind tunnel of DLR, 15:2378 (RA;DK)
Cooling
Coolant passage heat transfer with rotation, 15:3201 (RA;US)
Dynamic Loads
Generation of fatigue loads on Windane 40/2, 15:2382 (R;DK;In Danish)
Prediction of stochastic blade responses using a filtered noise turbulence model in the FLAP code, 15:2393 (BA;US)
Prediction of stochastic blade responses using measured wind speed data as input to the FLAP code, 15:2392 (BA;US)
Fatigue
Constitutive modelling of single crystal and directionally solidified superalloys, 15:2843 (RA;US)
Generation of fatigue loads on Windane 40/2, 15:2382 (R;DK;In Danish)
Flow Visualization
Location of flow separation on an 11 m wind turbine blade by means of flow visualization and a two dimensional airfoil code, 15:2373 (RA;DK)
Fluid Flow
Coolant passage heat transfer with rotation, 15:3201 (RA;US)
Foils
Aerofoil design and testing (Wind turbines), 15:2370 (RA;DK)
Airfoil design for horizontal axis wind turbines, 15:2377 (RA;DK)
Design of aerofoils for wind turbine use, 15:2375 (RA;DK)
Wind tunnel tests of airfoil sections extended to high angles of attack, 15:2371 (RA;DK)
Heat Transfer
Coolant passage heat transfer with rotation, 15:3201 (RA;US)
Pressure Drop
Coolant passage heat transfer with rotation, 15:3201 (RA;US)
Rotation
Some physical and numerical aspects of wind turbine aerodynamics, 15:2366 (RA;DK)
Service Life
Gas turbine blade life assessment and repair guide: Final report, 15:2414 (R;US)
Stress Analysis
Fatigue characterization of a VAWT blade material, 15:2396 (BA;US)
Probabilistic structural analysis methods of hot engine structures, 15:3248 (R;US)
Three-dimensional inelastic analysis methods for hot section components, 15:3237 (RA;US)
Surface Forces
On the usefulness of surface pressure calculations with a panel method for wind turbines, 15:2374 (RA;DK)
Wind Loads
Derivation of three-dimensional airfoil data on the basis of experiment and theory, 15:2372 (RA;DK)

TURBULENT FLOW
Comparison of turbulence measurement methods, 15:3195 (RA;US)
Head-on collision of viscous vortex rings, 15:3205 (RA;US)
Phase decorrelation, streamwise vortices and acoustic radiation in mixing layers, 15:3204 (RA;US)
Simulations of local Nusselt number using an algebraic stress model (ASM) for turbulent flow in a square 180 degree bend, 15:3937 (R;US)
Studying turbulence using numerical simulation databases, 2. Proceedings of the 1988 Summer Program, 15:3203 (R;US)
Survey of measurements and measuring techniques in rapidly distorted compressible turbulent boundary layers, 15:3185 (R;FR)
Two- and three-dimensional turbine blade row flow field simulations, 15:3200 (RA;US)
User manual and program documentation for the "TUFCA" flow program, 15:3112 (RA;DK;In Danish)

TURKEY
Current measurement studies around the Cesme Peninsula (Turkey), 15:3569 (R;XA)

TURNOVER (RADIONUCLIDES)
See RADIONUCLIDE KINETICS

TVO-1 REACTOR
Operation of Finnish nuclear power plants. Quarterly report, 2. quarter 1988, 15:2451 (R;FI)
Operation of Finnish nuclear power plants. Quarterly report, 3. quarter 1988, 15:2452 (R;FI)

TVO-2 REACTOR
Operation of Finnish nuclear power plants. Quarterly report, 2. quarter 1988, 15:2451 (R;FI)
Operation of Finnish nuclear power plants. Quarterly report, 3. quarter 1988, 15:2452 (R;FI)
TWO-DIMENSIONAL ELECTROPHORESIS
The current status of two-dimensional electrophoresis in germ cell mutation research, 15:3365 (R;US)
TWO-PHASE FLOW
Comparisons of two-phase microgravity calculations using current and new flow regime maps in RELAP5, 15:3209 (J;US)
Course A—Numerical modeling of two-phase flows for presentation at Ecole d'Ete d'Analyse Numerique, 15:2516 (R;US)
Interfacial area in two-phase flow, 15:3187 (R;US)
Magnetically suspended centrifuge for studies of nonlinear phenomena in stratified fluids: Developmental aspects, 15:3211 (J;US)

U

UCLBL
See LAWRENCE BERKELEY LABORATORY
UCLLL
See LAWRENCE LIVERMORE LABORATORY
UJM
See JET MODEL
UJV
List of publications 1988, 15:4496 (R;CS;In Czech, English)
ULTRASONIC WAVES
Free radical generation by ultrasound in aqueous solutions of DNA constituents, 15:3718 (RA;DE)
Methods of improving the quality of examinations in radiodiagnosis, 15:3632 (RA;SU;In Russian)
Noncontacting laser ultrasonic generation and detection at the surface of molten metal, 15:2834 (R;US)
ULTRASONICS
See ULTRASONIC WAVES
UNCORRELATED-JET MODEL
See JET MODEL
UNDERGROUND EXPLOSIONS
Environmental corrections for a neutron-induced gamma-ray spectroscopy logging system in an air-filled borehole, 15:3390 (R;US)
UNDERGROUND FACILITIES
See also WIPP
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 1, 15:2190 (R;US)
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 2, 15:2191 (R;US)
UNDERGROUND MINING
VG annual report 1988. Activity report of the Versuchsgrubengesellschaft mbH, Versuchsgrube Tremonia in Dortmund, 15:2086 (R;DE;In German, English)
UNDULATORS
See WIGGLER MAGNETS
UNION OF SOVIET SOCIALIST REPUBLICS
See USSR
UNIPOLAR TRANSISTORS
See FIELD EFFECT TRANSISTORS
UNITED KINGDOM
Electricity producing renewable energy technologies common costing methodology. V. 2, 15:2647 (R;GB)
Small scale hydroelectric generation potential in the UK. V. 1, 15:2276 (R;GB)
UNITED STATES OF AMERICA
See USA
UNIVERSE
Surface tension of strange-quark matter in the early Universe, 15:3880 (J;US)
Universe as a topological defect in a higher-dimensional Einstein-Yang-Mills theory, 15:3827 (R;JP)
UNIVERSITIES
See EDUCATIONAL FACILITIES
UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY
See LAWRENCE BERKELEY LABORATORY
URACILS
Radiation induced release of undamaged uracil from polyuridylic acid and the formation of phosphomonoester end groups in irradiated polynucleotides, 15:3727 (RA;DE)
URANIUM
Evaluation of the ground-water contaminant plume extending from the 183-H Solar Evaporation Basins, 15:2225 (R;US)
The behavior and chemical toxicity of U in the kidney: A reassessment, 15:3753 (J;US)
Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987, 15:4416 (R;XA)
U, Th and K distributions inferred from regional geology and the terrestrial radiation profiles in India, 15:3505 (R;IN)
URANIUM 234
Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)
Geochemical of the sodic-uranium metasomatic mineralization from Espinhas (PB)-Brazil, 15:2160 (R;BR;In Portuguese)
URANIUM 235
(e,e'f) coincidence experiments for fission decay of giant resonances in ^{235,238}U, 15:4113 (RA;DE;In German)
Determination of U-235 quantity in non-irradiated nuclear fuels using the neutrons coincidence method, 15:2168 (R;BR;In Portuguese)
URANIUM 235 TARGET
(e,e'f) coincidence experiments for fission decay of giant resonances in ^{235,238}U, 15:4113 (RA;DE;In German)
Target and method for the production of fission product molybdenum-99, 15:3105 (P;US)
URANIUM 236
Detection of the γ branch for the shape isomer in ^{236}U, 15:4118 (RA;DE;In German)
URANIUM 238
(e,e'f) coincidence experiments for fission decay of giant resonances in ^{235,238}U, 15:4113 (RA;DE;In German)
Development of sequential analytical method for the determination of U-238, U-234, Th-232, Th-230, Th-228, Ra-226 and Ra-228 and its application in mineral waters, 15:3046 (R;BR;In Portuguese)
Geochemical of the sodic-uranium metasomatic mineralization from Espinhas (PB)-Brazil, 15:2160 (R;BR;In Portuguese)
Measurements of prompt fission neutron spectra and double-differential neutron inelastic-scattering cross sections for ^{238}U and ^{232}Th, 15:4119 (R;JP;In Japanese)
Results of the radiological survey at 133 Maywood Avenue, Maywood, New Jersey (MJ025), 15:3510 (R;US)
Results of the radiological survey at 72 Sidney Stret, Lodi, New Jersey (LJ067), 15:3509 (R;US)
URANIUM 238 TARGET
(e,e'f) coincidence experiments for fission decay of giant resonances in ^{235,238}U, 15:4113 (RA;DE;In German)
URANIUM ALLOYS
See also URANIUM BASE ALLOYS
Evaluation and thermodynamic analysis of phase equilibria in the U-Al system, 15:2869 (J;NL)
High-temperature interdiffusion and phase equilibria in U-Mo, 15:2868 (J;NL)
Status of high-density fuel plates fabrication: Final draft, 15:2164 (R;US)
URANIUM BASE ALLOYS
Stress corrosion cracking of an uranium-6 weight per cent niobium in gaseous oxygen, nitrogen and hydrogen, 15:2814 (R;FR;In French)
URANIUM COMPOUNDS
See also URANIUM FLUORIDES
URANIUM OXIDES
Fermi surface and effective masses for the heavy-electron superconductor UPt_3, 15:4248 (R;US)

Possible FERMI liquid behavior of 5f electrons in UPt_3 at $T \gg T_K$, 15:4232 (R;US)

URANIUM DIOXIDE
Evaluation of the results from uranium chemical analysis by potentiometric tritation method for safeguards utilization through intercomparison programs, 15:3054 (R;BR;In Portuguese)
Evaluation of the utilization of neutron activation analysis for measuring non-irradiated nuclear fuels for safeguards, 15:2167 (R;BR;In Portuguese)
Studies of the ternary phase diagram U-Pu-O between 1000 and 2000deg C. Structural and physico-chemical properties of $Pu_xU_yO_z$ mixed oxides with a view to applications as fuel, 15:2919 (R;DE;In German)

URANIUM FLUORIDES
See also URANIUM TETRAFLUORIDE
Determination of HF in UF_4 contaminated by UO_2F_2, 15:2161 (R;BR;In Portuguese)

URANIUM II
See URANIUM 234

URANIUM ISOTOPES
See also URANIUM 234
URANIUM 235
URANIUM 236
URANIUM 238
Intercomparison of U-238 deposits employed for neutron fluence determination in neutron activation cross section measurements, 15:4111 (R;US)

URANIUM MINERALS
Licesing of mining and milling facilities of uranium and/or thorium ores, 15:2248 (R;BR;In Portuguese)

URANIUM OXIDES
See also URANIUM DIOXIDE
Study on behaviour of voltametric wave of UO_2^{2+} in an electrode of mercury pendent drop and H_2SO_4 as suport electrolyte, 15:3051 (R;BR;In Portuguese)

URANIUM TETRAFLUORIDE
Determination of HF in UF_4 contaminated by UO_2F_2, 15:2161 (R;BR;In Portuguese)
Use of uranium in filtrated from preparation process uranium tetrafluoride by umid via, 15:2162 (R;BR;In Portuguese)

URANYL COMPLEXES
Analytical use of zide ion. Chemical equilibrium studies and correlates in U(VI)/N_3 and Co(III)/N_3 systems, 15:3047 (R;BR;In Portuguese)

URANYL NITRATES
Subcriticality of two uranyl nitrate slab tanks spaced in air by the ^{252}CF-source-driven noise analysis method, 15:3125 (R;US)

URBAN AREAS
Comparison of 0600-0900 AM hydrocarbon compositions obtained from 29 cities, 15:3431 (R;US)
Complex mixtures of urban air pollutants: Identification and comparative assessment of mutagenic and tumorigenic chemicals and emission sources, 15:3784 (R;US)
Development of an inventory of materials potentially sensitive to ambient atmospheric acidity in the South Coast Air Basin. Final report, 15:3558 (R;US)
Influence of discharge and urbanization on the concentration, speciation, and bioavailability of trace metals in the Raritan River, New Jersey. Final report, 15:3551 (R;US)
Sensitivity of a regional oxidant model to variations in climate parameters. Volume 1 and 2. Final report, 15:3453 (R;US)
Turning off the tap: Strategies for hazardous waste minimization in the city of Los Angeles, 15:2776 (R;US)
Understanding the dynamics of innovation in urban transit. Final report on Phase 2, 15:2714 (R;US)
Urban Transportation Abstracts. Volume 7, 1988. Report for September 1988-February 1989, 15:2712 (R;US)

URETHANE
Synthesis of acrylated urethane oligomer, 15:3080 (R;MY)

US COAST GUARD
Evaluation of fuel-cell technology for Coast Guard applications. Final report, 15:2653 (R;US)

US DOE
See also ANL
BNL
BONNEVILLE POWER ADMINISTRATION
HAPO
HANFORD RESERVATION
IDAHO NATIONAL ENGINEERING LABORATORY
LANL
LAWRENCE BERKELEY LABORATORY
LAWRENCE LIVERMORE LABORATORY
ORNL
ROCKY FLATS PLANT
SANDIA LABORATORIES
WIPP
Implementation of the land-based national telecommunications networks, 15:4537 (R;US)

US EPA
EPA (Environmental Protection Agency) programs and the regulation of carcinogens: Methods and philosophies. Technical report, 15:3786 (R;US)
EPA's (Environmental Protection Agency's) approach to pollution prevention, 15:2595 (R;US)

US NRC
Directory of certificates of compliance for radioactive materials packages: Certificates of compliance: Volume 2, Revision 12, 15:2174 (R;US)
Directory of certificates of compliance for radioactive materials packages: Report of NRC approved packages: Volume 1, Revision 12, 15:2173 (R;US)
NRC Regulatory Agenda: Quarterly report, July–September 1989, 15:2468 (R;US)
NRC regulatory information conference: Proceedings: Volume 1, 15:2538 (R;US)
Reactor Safety Assessment System, 15:2482 (BA;US)
Title list of documents made publicly available, August 1–31, 1989: Volume 2, No. 8, 15:2467 (R;US)
Title list of documents made publicly available, July 1–31, 1989, 15:2466 (R;US)

US OSHA
Testimony of the National Institute for Occupational Safety and Health on the Occupational Safety and Health Administration's proposed rule on hazard communication, 15:3684 (R;US)

US WATER POLLUTION CONTROL ACT
See CLEAN WATER ACT

USA
See also FEDERAL REGION I
FEDERAL REGION X
WASHINGTON DC
A county-level approach to regional resource analysis based on climate simulation, 15:3396 (J;US)
Can the U.S. economy survive a few nuclear weapons, 15:2804 (J;US)
Crystalline silicon photovoltaic cell technology: Meeting the challenge for utility power, 15:2313 (BA;US)
Hostile intelligence threat: US technology, 15:2611 (R;US)
Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook, 15:2601 (R;US)
The electric-utility industry perspective, 15:2627 (RA;US)
US and Canadian emissions inventory, 1985. Report for March-September 1988, 15:3442 (R;US)

USSR
Can the U.S. economy survive a few nuclear weapons, 15:2804 (J;US)
System software for Soviet computers, 15:4526 (R;US)
The degradation of natural resources in the Soviet Union, 15:3593 (R;US)

USTAV JADERNYCH VYZKUMU
See UJV

UTERINE CERVIX CARCINOMA
See CARCINOMAS

V

VACUUM POLARIZATION
Effect of vacuum polarization on the sub-Coulomb ^{12}C-^{12}C scattering, 15:4077 (RA;DE;In German)

VACUUM SYSTEMS
Pretreatment and conditioning of storage ring vacuum systems, 15:3315 (R;US)
Proceedings of the Japan-U.S. workshop P-118 on vacuum technologies for fusion devices, 15:4419 (R;JP)

VALENCE ELECTRONS
See ELECTRONS

VALINOMYCIN
Optically based potassium sensor, 15:3372 (R;US)

VALLEYS
Modeling bulk atmospheric drainage flow in a valley, 15:3400 (J;US)

VALVES
Evaluation of check valve monitoring methods, 15:2479 (R;US)

VAN ALLEN BELTS
See RADIATION BELTS

VANADIUM
Nuclear spin relaxation of ^{12}B implanted in various metallic single crystals, 15:4228 (RA;DE;In German)

VANADIUM ALLOYS
See also VANADIUM BASE ALLOYS
Influence of microstructure and microdamage processes on fracture at high loading rates. Final report, 1 February 1986-30 September 1988, 15:2806 (R;US)

VANADIUM BASE ALLOYS
Structure and insulator material choices for the TITAN reversed-field-pinch reactor study, 15:4470 (BA;US)

VANADIUM MINERALS
See MINERALS

VANES
Three-dimensional inelastic analysis methods for hot section components, 15:3237 (RA;US)

VAR COMPENSATORS
See VAR CONTROL SYSTEMS

VAR CONTROL SYSTEMS
Knowledge-based system: Voltage and VAR [volt-ampere-reactive] dispatch: Final report, 15:2411 (R;US)

VARIABLE STARS
See also PULSATING VARIABLE STARS
Pulsations of B stars: A review of observations and theories, 15:3869 (BA;US)

VASCULAR DISEASES
Positron emission tomography of the lung, 15:3681 (BA;US)

VEGETATION
See PLANTS

VEHICLES
See also AUTOMOBILES
ELECTRIC-POWERED VEHICLES
SPACE VEHICLES
Measurement of on-road vehicle emission factors in the California South Coast Air Basin. Volume 1. Regulated emissions. Final report, 15:2796 (R;US)
Mobile air-conditioner refrigerant evaluation. Report for April 1988-March 1989, 15:3441 (R;US)
Programmer's guide to MOBILE4 (mobile source emission factor model). Technical report, 15:2797 (R;US)
Waste audit study: Automotive paint shops, 15:2744 (R;US)

VENTILATION
Efficiency measurements of ventilation, 15:2705 (R;FI;In Finnish)

VENTILATION DUCTS
See DUCTS
VENTILATION

VENTILATION SYSTEMS
Design instructions for ventilation of day-care centres, 15:2684 (R;FI;In Finnish)
Displacement ventilation - dimensioning of supply air flow, 15:2683 (R;FI;In Finnish)

VERSATOR TOKAMAK
Production of high poloidal tokamak equilibria in Versator II by means of RF current drive, 15:4323 (RA;JP)

VERTEBRAE
Computerized tomography in diagnosis of dystrophic vertebrae lesions, 15:3628 (RA;SU;In Russian)

VERTICAL AXIS TURBINES
Aerodynamic performance of the Sandia National Laboratories 34-meter-diameter vertical axis wind turbine test bed, 15:2407 (BA;US)
Effect of turbulence scale on VAWT aerodynamic response, 15:2390 (BA;US)
Fatigue characterization of a VAWT blade material, 15:2396 (BA;US)
Finite difference analysis of the three dimensional flow field of a vertical axis wind turbine, 15:2391 (BA;US)
Initial structural response measurements for the Sandia 34-meter VAWT test bed, 15:2406 (BA;US)
Model validation of the Sandia 34-meter test bed turbine using substructured modal-testing, 15:2408 (BA;US)
Time domain structural response calculations for vertical axis wind turbines, 15:2401 (BA;US)
VAWT dynamic stall models revisited, 15:2394 (BA;US)

VESSELS
See CONTAINERS

VESSELS (CHEMICAL REACTIONS)
See CHEMICAL REACTORS

VESSELS (PRESSURE)
See PRESSURE VESSELS

VESSELS (REACTOR)
See REACTOR VESSELS

VIBRATIONAL BAND
See VIBRATIONAL STATES

VIBRATIONAL STATES
The initial scientific program at the NSLS infrared beamline, 15:4204 (R;US)

VIBRATIONS (MECHANICAL)
See MECHANICAL VIBRATIONS

VINYL CYANIDE
See ACRYLONITRILE

VINYLBENZENE
See STYRENE

VISCOSIMETERS
Rheological measurements on cement grouts, 15:2177 (R;GB)

VISCOSITY
Advanced research in instrumentation and control technology, 15:2053 (R;US)

VISION
Behavioral measurement of laser flashblindness in rhesus monkeys. Final report, June-August 1985, 15:3796 (R;US)

VISITOR CENTERS
See PUBLIC BUILDINGS

VOLATILE MATTER
Destruction of volatile organic compounds using catalytic oxidation. Report for April 1987-December 1988, 15:3439 (R;US)
Estimating human-equivalent no observed adverse-effect levels for VOCs (volatile organic compounds) based on minimal knowledge of physiological parameters. Technical paper, 15:3783 (R;US)
Steam stripping and batch distillation for the removal/recovery of volatile organic compounds, 15:2736 (R;US)

VOLT-AMPERE REACTIVE CONTROL SYSTEMS
See VAR CONTROL SYSTEMS

VOLTAIC CELLS
See ELECTRIC BATTERIES

VORTEX FLOW
Aerothermal modeling program. Phase 2, element B: Flow interaction experiment, 15:3197 (RA;US)
Numerical simulation of the compressible Orszag-Tang vortex. Interim report, June 1988-February 1989, 15:3935 (R;US)

VORTICES
Head-on collision of viscous vortex rings, 15:3205 (RA;US)

W

W CODES
Window 3.1: A computer tool for analyzing window thermal performance, 15:2342 (BA;US)

W MINUS BOSONS
How to study longitudinal *W*'s in the TeV region, 15:4012 (J;US)

W PLUS BOSONS
How to study longitudinal *W*'s in the TeV region, 15:4012 (J;US)

WAKEFIELD ACCELERATORS
A photon accelerator, 15:3279 (R;US)
Wakefield accelerator in a magnetized electron-positron plasma, 15:3262 (R;XA)

WARFARE
See also CONVENTIONAL WARFARE
Engineering Assignment 5, E-4B surveillance methodology. Final report, 15:3386 (R;US)
Volunteering for emergency preparedness. Final report, March 1988-March 1989, 15:4550 (R;US)

WASHINGTON
Radiological surveys of Naval facilities on Puget Sound. Final report, 15:3571 (R;US)

WASHINGTON DC
An acid rain study in the Washington, D.C. area, 15:3472 (J;US)

WASTE CHEMICALS
See CHEMICAL WASTES

WASTE DISPOSAL
See also GROUND DISPOSAL
RADIOACTIVE WASTE DISPOSAL
SANITARY LANDFILLS

Ground Disposal
Response to capacity-related comments submitted on the Second Third proposed land disposal restrictions rule, 15:3520 (R;US)
Response to comments: Background document for the second third-land disposal restrictions proposed rule: Policy-related comments, 15:3518 (R;US)
Response to the Second Third wastes treatment standards: Related comments for the Second Third land-disposal restrictions proposed rule (Issue Numbers 1 through 12), 15:3519 (R;US)

Incinerators
Incinerability index: A measure of incinerator performance, 15:2743 (R;US)
Trial burns: methods perspective, 15:2763 (R;US)

Institutional Factors
Safe disposal of hazardous wastes: The special needs and problems of developing countries. Volume 1-Volume 3. World Bank technical paper, 15:2750 (R;US)

Land Pollution
Bench-scale fixation of soils from the Tacoma Tar Pits Superfund Site. Final report, 15:3521 (R;US)
Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska, 15:2717 (R;US)
Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska, 15:2716 (R;US)
Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska, 15:2721 (R;US)
Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska, 15:2723 (R;US)
Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska, 15:2722 (R;US)
Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska, 15:2720 (R;US)
Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska, 15:2719 (R;US)
Installation-Restoration Program Preliminary Assessment, Naknek Recreational Camps, Alaska, 15:2718 (R;US)
Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report, 15:3527 (R;US)
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988, 15:3526 (R;US)
Superfund Record of Decision (EPA Region 2): Ciba-Geigy, NJ. (First Remedial Action), April 1989, 15:3530 (R;US)
Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action, 15:3591 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989, 15:3534 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report, 15:3523 (R;US)
Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report, 15:3528 (R;US)
Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report, 15:3532 (R;US)
Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988, 15:3524 (R;US)
Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988, 15:3500 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)

Land Reclamation
Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988, 15:3529 (R;US)

Manuals
Safe disposal of hazardous wastes: The special needs and problems of developing countries. Volume 1-Volume 3. World Bank technical paper, 15:2750 (R;US)

Mutagens
Application of a simple short-term bioassay for the identification of genotoxins from hazardous wastes, 15:3782 (R;US)

Risk Assessment
Analytical methods necessary to implement risk-based criteria for chemicals in municipal sludge, 15:2775 (R;US)
Below Regulatory Concern (BRC) Owners Group: A comparison of the EPA generic cost-benefit analysis with an industry-specific analysis: Final report, 15:2195 (R;US)

Site Characterization
Air quality monitoring at toxic waste sites: A Hanford perspective, 15:3464 (R;US)

Water Pollution
Influence of discharge and urbanization on the concentration, speciation, and bioavailability of trace metals in the Raritan River, New Jersey. Final report, 15:3551 (R;US)
Installation-Restoration Program Preliminary Assessment Bethel Radio Relay Station, Alaska, 15:2717 (R;US)
Installation-Restoration Program Preliminary Assessment Kalakaket Creek Radio Relay Station, Alaska, 15:2716 (R;US)
Installation-Restoration Program Preliminary Assessment, Bear Creek Radio Relay Station, Alaska, 15:2721 (R;US)
Installation-Restoration Program Preliminary Assessment, Big Mountain Radio Relay Station, Alaska, 15:2723 (R;US)
Installation-Restoration Program Preliminary Assessment, Canyon Creek Radio Relay Station, Alaska, 15:2722 (R;US)
Installation-Restoration Program Preliminary Assessment, Gold King Creek Radio Relay Station, Alaska, 15:2720 (R;US)
Installation-Restoration Program Preliminary Assessment, Granite Mountain Radio Relay Station, Alaska, 15:2719 (R;US)
Installation-Restoration Program Preliminary Assessment, Naknek Recreational Camps, Alaska, 15:2718 (R;US)

ROD (Record of Decision) annual report, FY 1988, 15:3590 (R;US)
Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report, 15:3527 (R;US)
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988, 15:3526 (R;US)
Superfund Record of Decision (EPA Region 2): Ciba-Geigy, NJ. (First Remedial Action), April 1989, 15:3530 (R;US)
Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action, 15:3591 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989, 15:3534 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 3): Wildcat Landfill, DE. (Second Remedial Action), November 1988. Final report, 15:3535 (R;US)
Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988, 15:3533 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report, 15:3523 (R;US)
Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report, 15:3528 (R;US)
Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report, 15:3532 (R;US)
Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988, 15:3524 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)

Water Reclamation
Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988, 15:3529 (R;US)

WASTE HEAT BOILERS
Condensing boilers, 15:2679 (R;GB)

WASTE ISOLATION PILOT PLANT
See WIPP

WASTE MANAGEMENT
See also RADIOACTIVE WASTE MANAGEMENT
WASTE DISPOSAL
WASTE PROCESSING
WASTE TRANSPORTATION
EPA's (Environmental Protection Agency's) approach to pollution prevention, 15:2595 (R;US)
Quality assurance guidance for TRUPACT-II [Transuranic Package Transporter-II] payload control, 15:2189 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Printing and publishing, 15:2738 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Analytical laboratories, 15:2740 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Wood-treating industries, 15:2737 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Dry cleaners and commercial laundries, 15:2739 (R;US)
Waste audit study: Automotive paint shops, 15:2744 (R;US)
Waste audit study: Research and educational institutions, 15:2746 (R;US)
Waste-minimization insights for the polymer industry, 15:2742 (R;US)

WASTE OILS
Guide to oil waste-management alternatives for used oil, oily waste water, oily sludge, and other wastes resulting from the use of oil products. Final report, 15:2127 (R;US)

WASTE PROCESSING
See also RADIOACTIVE WASTE PROCESSING
Best demonstrated available technology (BDAT) background document for K009 and K010, 15:2768 (R;US)
Best demonstrated available technology (BDAT) background document for K011, K013, and K014. Final report, 15:2769 (R;US)
Best demonstrated available technology (BDAT) background document for K043. Final report, 15:2771 (R;US)
Best demonstrated available technology (BDAT) background document for cyanide wastes, 15:2770 (R;US)
Best demonstrated available technology (BDAT) background document for organophosphorous wastes, 15:2766 (R;US)
Best demonstrated available technology (BDAT) background document for phthalate wastes, 15:2767 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of dinitrotoluene, toluenediamine, and toluene diisocyanate (K027, K111, K112, K113, K114, K115, K116, U221, and U223). Final report, 15:2774 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of chlorinated aliphatic hydrocarbons F024. Final report, 15:2772 (R;US)
Best demonstrated available technology (BDAT) background document for wastes from the production of 1,1,1-trichloroethane K028, K029, K095, and K096. Final report, 15:2773 (R;US)
Methodology for developing best demonstrated available technology (BDAT) treatment standards, 15:2765 (R;US)
Recovery of metals using aluminum displacement, 15:2741 (R;US)
Response to the Second Third wastes treatment standards: Related comments for the Second Third land-disposal restrictions proposed rule (Issue Numbers 1 through 12), 15:3519 (R;US)
Treatment technology background document, 15:2764 (R;US)
Wastepaper recycling. January 1976-September 1989 (Citations from the Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989, 15:2751 (R;US)

WASTE PROCESSING PLANTS
Risk assessment and risk management for an experimental nuclear waste processing facility, 15:2193 (R;US)

WASTE PRODUCT UTILIZATION
Basic investigation of mixtures consisting of binders and tailings from coal mining with regard to their applicability as building materials in the mining industry, 15:2072 (R;DE;In German)

WASTE SOLUTIONS
See LIQUID WASTES

WASTE TRANSPORTATION
Quality assurance guidance for TRUPACT-II [Transuranic Package Transporter-II] payload control, 15:2189 (R;US)

WASTE TREATMENT
See WASTE PROCESSING

WASTE WATER
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report, 15:3574 (R;US)
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report, 15:3573 (R;US)

Final report on the investigation of water purification and waste concentration by the Vacuum Freezing Multiple Phase Transformation Process and its eutectic extension, September 1986-September 1987, 15:3572 (R;US)
Guide to oil waste-management alternatives for used oil, oily waste water, oily sludge, and other wastes resulting from the use of oil products. Final report, 15:2127 (R;US)
Hybrid knowledge-based/algorithmic approach to the design of waste-treatment systems, 15:3234 (R;US)
Pulping effluents: Biological treatment. January 1976-September 1989 (Citations from the Paper and Board, Printing, and Packaging Industries Research Associations data base). Report for January 1976-September 1989, 15:2752 (R;US)
Waste-water characterization survey, Little Rock AFB, Arizona. Final report, 11-24 July 1988, 15:3577 (R;US)
Wastewater treatment: Chemical industry. January 1970-September 1989 (Citations from Pollution Abstracts). Report for January 1970-September 1989, 15:3563 (R;US)
Water treatment: Air stripping. December 1981-July 1989 (Citations from the Selected Water Resources Abstracts data base). Report for December 1981-July 1989, 15:3562 (R;US)

WASTE-FUELED BOILERS
See REFUSE-FUELED BOILERS

WATER
See also DRINKING WATER
GROUND WATER
HEAVY WATER
RAIN WATER
SEAWATER
WASTE WATER
The influence of adsorbate–absorbate hydrogen bonding in molecular chemisorption: NH_3, HF, and H_2O on Au(111), 15:3094 (J;US)
The reactions of iron clusters with water, 15:3091 (J;US)

WATER COOLANT
See WATER

WATER DISTRIBUTION
See WATER SUPPLY

WATER HEATERS
See also SOLAR WATER HEATERS
Extended range tankless water heater: Quarterly report No. 2, July 20, 1989–October 19, 1989, 15:2671 (R;US)
Extended range tankless water heater: Quarterly report, April 19–July 19, 1989, 15:2725 (R;US)

WATER HEATING
See also SOLAR WATER HEATING
Space and hot water heating: energy-efficiency in large gas-fired systems, 15:2663 (R;GB)

WATER MODERATOR
See WATER

WATER POLLUTION
Methods for aquatic toxicity-identification evaluations. Phase 2. Toxicity identification procedures. Technical report, 15:3550 (R;US)
Methods for aquatic toxicity-identification evaluations. Phase 3. Toxicity confirmation procedures. Technical report, 15:3549 (R;US)

Flow Models
Establishment of a Ground Water Research Data Center for validation of subsurface flow and transport models. Final report, August 1986-November 1988, 15:3557 (R;US)

Forecasting
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Southern Blue Ridge Province data base, 15:3553 (R;US)

Regional Analysis
Re-examination of interim estimates of annual sulfur dry deposition across the eastern United States. Final report, 1988-1989, 15:3460 (R;US)

Remedial Action
Installation-Restoration Program Stage 3. McClellan AFB, California. Remedial investigation/feasibility study ground-water sampling and analysis program, January through March 1989 data summary. Final report, January-March 1989, 15:3542 (R;US)
ROD (Record of Decision) annual report, FY 1988, 15:3590 (R;US)
Superfund Record of Decision (EPA Region 1): Cannon Engineering, MA. (First Remedial Action), March 1988. Final report, 15:3527 (R;US)
Superfund Record of Decision (EPA Region 10): Commencement Bay/Near Shore, WA. (First Remedial Action), December 1988, 15:3526 (R;US)
Superfund Record of Decision (EPA Region 2): Ciba-Geigy, NJ. (First Remedial Action), April 1989, 15:3530 (R;US)
Superfund Record of Decision (EPA Region 2): Clothier Disposal Site, Oswego County, New York, December 28, 1988. First remedial action, 15:3591 (R;US)
Superfund Record of Decision (EPA Region 2): Lipari Landfill, Mantua Township, Gloucester County, New Jersey, July 11, 1988. Third remedial action. Final report, 15:3579 (R;US)
Superfund Record of Decision (EPA Region 3): Croyden TCE Spill, PA. (First Remedial Action), December 1988, 15:3586 (R;US)
Superfund Record of Decision (EPA Region 3): M. W. /Manufacturing, PA. (First Remedial Action), March 1989, 15:3534 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump Site, PA. (Second Remedial Action), September 1988, 15:3525 (R;US)
Superfund Record of Decision (EPA Region 3): Tyson's Dump, PA. (First remedial action), March 1988. Final report, 15:3589 (R;US)
Superfund Record of Decision (EPA Region 3): Wildcat Landfill, DE. (Second Remedial Action), November 1988. Final report, 15:3535 (R;US)
Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988, 15:3533 (R;US)
Superfund Record of Decision (EPA Region 5): Belvidere Landfill, IL. (First Remedial Action), June 1988, 15:3522 (R;US)
Superfund Record of Decision (EPA Region 5): Forest Waste Disposal, MI. (Second remedial action), March 1988, 15:3584 (R;US)
Superfund Record of Decision (EPA Region 5): Poer Farm, IN. (First Remedial Action), September 1988. Final report, 15:3523 (R;US)
Superfund Record of Decision (EPA Region 5): Summit National Site, Deerfield, OH. June 1988. First Remedial Action. Final report, 15:3528 (R;US)
Superfund Record of Decision (EPA Region 5): Wausau Water Supply, WI. (First Remedial Action), December 1988, 15:3587 (R;US)
Superfund Record of Decision (EPA Region 6): Pesses Chemical, TX. (First Remedial Action), December 1988. Final report, 15:3532 (R;US)
Superfund Record of Decision (EPA Region 6): South Valley/Edmunds Street, NM. (Second Remedial Action), June 1988, 15:3524 (R;US)
Superfund Record of Decision (EPA Region 7): Findett, MO. (First Remedial Action), December 1988, 15:3500 (R;US)
Superfund Record of Decision (EPA Region 7): Todtz, Lawrence Farm, IA. (First Remedial Action), November 1988. Final report, 15:3531 (R;US)

Standards
Water pollution: More EPA action needed to improve the quality of heavily polluted waters, 15:3547 (R;US)

Toxic Materials
Comparison of bioassays for assessing sediment toxicity in Puget Sound. (Appendices included). Report for 1988-1989 (Final), 15:3561 (R;US)

WATER POLLUTION CONTROL
Oil-spill removal techniques and equipment. January 1973-September 1989 (Citations from Fluidex data base). Report for January 1973-September 1989, 15:2133 (R;US)
Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly, 15:3580 (R;US)

Role of standards in Iowa's ground-water protection program: A report to the Iowa General Assembly. Appendix 2. Written comments, 15:3581 (R;US)

WATER PUMPS
Multiloop integral system test (MIST): Test Group 36, Pump operation: Final report: Volume 8, 15:2550 (R;US)

WATER QUALITY
Formulation of water-quality models for streams, lakes, and reservoirs: Modeler's perspective. Final report, 15:3544 (R;US)

WATER RECLAMATION
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Data supplement for annual report, June 11, 1974-June 10, 1975. Technical report, 15:3573 (R;US)
Cape Cod Waste-water Renovation and Retrieval System. A study of water treatment and conservation. Interim report, June 11, 1975-June 10, 1976. Technical report, 15:3574 (R;US)
Selection with minimal bias, of an experimental control from natural wetland environments. Technical report (Final), 15:3576 (R;US)
Superfund Record of Decision (EPA Region 8): Libby Ground Water Contamination, MT. (Second Remedial Action), December 1988, 15:3529 (R;US)

WATER RESERVOIRS
Sediment-water interactions and contaminants in Corps of Engineers reservoir projects. Final report, 15:3543 (R;US)

WATER RESOURCES
Ground-water research: Technical-Assistance Directory, 15:3575 (R;US)

WATER SOLUTIONS
See AQUEOUS SOLUTIONS

WATER SOURCE HEAT PUMPS
Effects on zooplankton when passing through an open lake water heat pump, 15:3800 (R;SE;In Swedish)

WATER SUPPLY
Ground water protection efforts in four new england states. Technical report, 15:3588 (R;US)
Superfund Record of Decision (EPA Region 5): Wausau Water Supply, WI. (First Remedial Action), December 1988, 15:3587 (R;US)
Translating research into practice: The drinking-water industry, 15:3578 (R;US)

WATER TREATMENT
Final report on the investigation of water purification and waste concentration by the Vacuum Freezing Multiple Phase Transformation Process and its eutectic extension, September 1986-September 1987, 15:3572 (R;US)
Formation and control of non-trihalomethane by-products, 15:3556 (R;US)
Translating research into practice: The drinking-water industry, 15:3578 (R;US)
Waste-water characterization survey, Little Rock AFB, Arizona. Final report, 11-24 July 1988, 15:3577 (R;US)
Water treatment: Air stripping. December 1981-July 1989 (Citations from the Selected Water Resources Abstracts data base). Report for December 1981-July 1989, 15:3562 (R;US)

WATER TREATMENT PLANTS
Hybrid knowledge-based/algorithmic approach to the design of waste-treatment systems, 15:3234 (R;US)

WATER UTILITIES
Translating research into practice: The drinking-water industry, 15:3578 (R;US)

WATERBORNE PARTICLES
See PARTICULATES

WATERSHEDS
Characterization of year-round sensitivity of California's Montane Lakes to acidic deposition. Final report, October 1986-June 1989, 15:3552 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Northeast data base, 15:3555 (R;US)
Geographic information system documentation of watershed data for Direct/Delayed Response Project. Southern Blue Ridge Province data base, 15:3553 (R;US)

WAVEGUIDES
Method of fabricating optical waveguides by ion implantation doping, 15:2964 (P;US)

WAVES (SHOCK)
See SHOCK WAVES

WAZ 16
See NICKEL BASE ALLOYS

WEAK INTERACTIONS
Electroweak interactions with gauged baryon and lepton numbers, 15:4061 (J;US)

WEAK NEUTRAL CURRENTS
Second class currents and the β-particle asymmetry at the decay of oriented ^{24m}Na nuclei, 15:4158 (R;SU)

WEAK PARTICLE DECAY
QCD corrections to weak decays, 15:3982 (R;US)

WEAR
Computer-controlled test system for operating different wear-test machines, 15:3216 (R;US)
The modeling of wear in energy conversion and utilization technologies: Proceedings, 15:3214 (R;US)

WEATHERIZATION
Radon monitoring results from BPA's Residential Weatherization Program: Report No. 10, 15:2665 (R;US)
Summary of residential environmental issues and program consistency, 15:2698 (R;US)

WECS
See WIND TURBINES

WELDED JOINTS
Experience with J testing of 304/308 stainless steel weldment, 15:2833 (R;US)

WELDS
See WELDED JOINTS

WELL BORE DAMAGE
See FORMATION DAMAGE

WELL COMPLETION
Altered-stress fracturing, 15:2117 (J;US)

WELL LOGGING
MCNP [Monte Carlo Neutron Photon] capabilities for nuclear well logging calculations, 15:3378 (R;US)

WELL SKIN EFFECT
See FORMATION DAMAGE

WELLS
See also NATURAL GAS WELLS
OIL WELLS
WES, a robust expert system for well test analysis, 15:2105 (R;US)

WENDELSTEIN-7 STELLARATOR
Proceedings of US-Japan workshop on new generation experiments and reactors (joined by EC), 15:4440 (R;JP)

WESTERN EUROPE
See also ITALY
UNITED KINGDOM
Defensive technologies for Europe, 15:3391 (BA;US)

WET-TYPE COOLING TOWERS
See COOLING TOWERS

WETLANDS
Inland wetlands legislation and management. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:3592 (R;US)
Innovation and teamwork in the North American waterfowl management plan. Waterfowl Management Handbook, 15:2601 (R;US)
Local government techniques for inland wetlands protection. Technical report, 15:3585 (R;US)
Selection with minimal bias, of an experimental control from natural wetland environments. Technical report (Final), 15:3576 (R;US)

WHITE DWARF STARS
Hydrodynamic studies of oxygen, neon, and magnesium novae, 15:3875 (BA;US)

WIGGLER MAGNETS
High-field pulsed microwigglers, 15:3157 (R;US)
Radiation of a finite electron-beam pulse in a free-electron laser amplifier, 15:4456 (BA;US)

Undulator sources at a 8 GeV storage ring, 15:3323 (R;JP)
WILD ANIMALS
Trends in radionuclide concentrations for wildlife and food products near Hanford for the period 1971 through 1988, 15:2232 (R;US)
WIND
Three-dimensional wind simulation, 15:2395 (BA;US)
WIND ENERGY CONVERSION SYSTEMS
See WIND TURBINES
WIND FARMS
See WIND TURBINE ARRAYS
WIND GENERATORS
See WIND TURBINES
WIND POWER
Detailed analysis of the wake and free-flow characteristics at the Goodnoe Hills MOD-2 site, 15:2381 (R;US)
Evaluation of the relation (coherence) between wind speed and various set parameters at the Naesudden wind power plant, 15:2386 (R;SE;In Swedish)
WIND POWER PLANTS
Computer simulation of wind/diesel system operation, 15:2383 (R;US)
WIND TUNNELS
Spectral characteristics of arc-heated low density plasma flows (3). Helium plasma, 15:3892 (R;JP;In Japanese)
WIND TURBINE ARRAYS
An initial look at the dynamics of the microscale flow field within a large wind farm in response to variations in the natural inflow, 15:2384 (R;US)
Windmills standing on the sea bed at Dvalegrunden. Draft project, 15:2364 (R;DK;In Danish)
WIND TURBINES
See also HORIZONTAL AXIS TURBINES
VERTICAL AXIS TURBINES
Aerodynamics
Joint action on aerodynamics of wind turbines, 15:2365 (R;DK)
Joint action on aerodynamics of wind turbines. Supplement, 15:2379 (R;DK)
Prediction of stochastic blade responses using a filtered noise turbulence model in the FLAP code, 15:2393 (BA;US)
Prediction of stochastic blade responses using measured wind speed data as input to the FLAP code, 15:2392 (BA;US)
Some physical and numerical aspects of wind turbine aerodynamics, 15:2366 (RA;DK)
Air Flow
Two simple models for dynamic inflow (Wind turbines), 15:2369 (RA;DK)
Computerized Control Systems
Development of the University of Massachusetts wind/diesel simulator, 15:2399 (BA;US)
Control
Adaptive pitch control for power regulation of the MS-2 wind turbine, 15:2363 (R;GB)
Fatigue
Preliminary results from the fatigue testing of northern power systems 100KW wind turbine, 15:2405 (BA;US)
Simplified fatigue damage and crack growth calculations for wind turbines, 15:2397 (BA;US)
Flow Models
Estimation of turbulence variance and scale, simplified for wind turbine applications, 15:2389 (BA;US)
Results from actuator surface theory applications on wind turbine rotors, 15:2376 (RA;DK)
Fracture Mechanics
Crack propagation analysis of WECS components using the LIFE2 computer code, 15:2398 (BA;US)
Meetings
Joint action on aerodynamics of wind turbines, 15:2365 (R;DK)
Metering
Advances in three-dimensional turbulence measurement capability, 15:2388 (BA;US)
Noise Pollution Abatement
Noise from larger windmills. Principles for the construction of windmills that produce less noise, 15:2380 (R;DK;In Danish)
Performance
A case study of a no storage wind/diesel system: Block Island, 15:2400 (BA;US)
Proceedings of the eighth ASME wind energy symposium, 15:2387 (B;US)
Performance Testing
Aerofoil design and testing (Wind turbines), 15:2370 (RA;DK)
Performance methods (again—), 15:2368 (RA;DK)
Rotors
Derivation of three-dimensional airfoil data on the basis of experiment and theory, 15:2372 (RA;DK)
WEG MS-2 stall-regulated rotor study, 15:2362 (R;GB)
Turbine Blades
Generation of fatigue loads on Windane 40/2, 15:2382 (R;DK;In Danish)
WINDOWS
A thermally insulating vacuum window, 15:2708 (BA;US)
A versatile procedure for calculating heat transfer through windows, 15:2690 (R;US)
Effect of shading devices on residential energy use in Austin, Texas. Research report, 15:2694 (R;US)
Spectral model for instantaneous advanced window performance, 15:2338 (BA;US)
Window 3.1: A computer tool for analyzing window thermal performance, 15:2342 (BA;US)
WINDSCALE REPROCESSING PLANT
See SELLAFIELD REPROCESSING PLANT
WINSTON COLLECTORS
See COMPOUND PARABOLIC CONCENTRATORS
WIPP
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 1, 15:2190 (R;US)
Geotechnical Field Data and Analysis Report, July 1987–June 1988: Volume 2, 15:2191 (R;US)
Quality assurance guidance for TRUPACT-II [Transuranic Package Transporter-II] payload control, 15:2189 (R;US)
Waste Isolation Pilot Plant (WIPP) TRU waste shipment dry run preoperational checkout plan, 15:2192 (R;US)
WISCONSIN
Water resources data for Wisconsin, Water Year 1988. Water-data report (Annual), 1 October 1987-30 September 1988, 15:3559 (R;US)
Wisconsin waste reduction and recovery plan, 15:2745 (R;US)
WOLFRAM
See TUNGSTEN
WOMEN
Simple application of probability model for the mean age at marriage, 15:4277 (R;XA)
WOOD
Combustion of fixed-bed in grate firing, 15:3115 (R;FI;In Finnish)
Effects of acid deposition on painted wood substrates, 15:3432 (R;US)
Handling characteristics of wood fuels - angle of repose for different assortments, 15:2274 (R;SE;In Swedish)
Separation of wood chips for energy production, 15:2275 (R;SE;In Swedish)
WOOD ALCOHOL
See METHANOL
WOOD BURNING APPLIANCES
Measurement of condensable vapor contribution to PM10 emissions, 15:2696 (R;US)
WOOD FUELS
Fuel-supply structure of wood-fired power plants in the Northeast: Loggers' perspective. Forest Service research paper, 15:2273 (R;US)
WOOD PRODUCTS INDUSTRY
See also PAPER INDUSTRY
Evaluation of emission sources from creosote wood-treatment operations. Final report, 15:2747 (R;US)
Small-quantity generator's handbook for managing RCRA (Resource Conservation and Recovery Act) wastes. Wood-treating industries, 15:2737 (R;US)

Superfund Record of Decision (EPA Region 4): American Creosote Works, TN. (First Remedial Action), December 1988, 15:3533 (R;US)

WOOD WASTES
Flue gas condensation in stoking system for wood chips, 15:2272 (R;DK;In Danish)
Wisconsin waste reduction and recovery plan, 15:2745 (R;US)

WOOD-FUEL POWER PLANTS
Fuel-supply structure of wood-fired power plants in the Northeast: Loggers' perspective. Forest Service research paper, 15:2273 (R;US)

WORKERS
See PERSONNEL

X

X RADIATION
See also SOFT X RADIATION
Center for X-ray Optics, 1988, 15:3264 (R;US)
Glancing angle x-ray studies of oxide films: Revision, 15:2903 (R;US)
Radiobiology of ultrasoft X rays. IV. Flat and round-shaped hamster cells (CHO-10B, HS-23), 15:3754 (J;US)
X and UV time resolving diagnostics for X-ray laser experiments, 15:4369 (BA;US)

X-RASERS
See X-RAY LASERS

X-RAY DIFFRACTION
Comment on "Speckle in the diffraction patterns of Hendricks-Teller and icosahedral glass models", 15:4241 (J;US)
Evaluation of a linear photodiode array detector for synchrotron small-angle x-ray scattering measurements, 15:3231 (J;US)

X-RAY DIFFRACTOMETERS
Studies of the ternary phase diagram U-Pu-O between 1000 and 2000deg C. Structural and physico-chemical properties of $Pu_xU_yO_z$ mixed oxides with a view to applications as fuel, 15:2919 (R;DE;In German)

X-RAY DOSIMETRY
Ionizing radiations dosimetry: new results in the megagray range, 15:4184 (R;FR;In French)

X-RAY EQUIPMENT
Conduct of local dosimetry in X-ray diagnosis, 15:4197 (R;DD;In German)

X-RAY LASERS
Prospects for a soft x-ray FEL powered by a relativistic-klystron high-gradient accelerator (RK-HGA), 15:3167 (R;US)

X-RAY RADIOGRAPHY
Technique for chest radiography for pneumoconiosis, 15:3678 (R;US)

XENON
Anharmonic damping in rare-gas multilayers, 15:2888 (J;US)
Experimental study of atomic structure in strong electromagnetic fields, 15:3916 (J;US)

XENON CHLORIDES
Ultrahigh brightness XeCl laser system, 15:3170 (BA;US)

XENON FLUORIDES
Dissociation and vibrational relaxation of XeF by various collision partners, 15:3146 (R;US)

XENON IONS
Development of a laser ion source for xenon, 15:3295 (RA;DE;In German)
Direct and resonance contributions to electron-impact excitation of n=2 to n=3 transitions in neonlike ions, 15:3907 (J;US)

XYLENES
Upgrading of light Fischer-Tropsch products: Quarterly report No. 6, January 1, 1988–March 31, 1988, 15:2264 (R;US)

Y

Y*RESONANCES
See BARYONS

YANG-MILLS THEORY
Global gauge anomalies for theories with the Green-Schwarz local-anomaly-cancellation mechanism, 15:4055 (J;US)
Towards a 'pointless' generalisation of Yang-Mills theory, 15:4046 (R;GB)
Universe as a topological defect in a higher-dimensional Einstein-Yang-Mills theory, 15:3827 (R;JP)
Vortex-like and string-like solutions for the 2+1 dimensional SU(2) Yang-Mills theory with the Chern-Simons term, 15:4037 (R;XA)

YOLK
See EGGS

YTTERBIUM 153
The study of exotic N $\simeq$ 82 nuclei using the Daresbury recoil mass separator, 15:4101 (R;US)

YTTERBIUM ISOTOPES
See also YTTERBIUM 153
Measurement of g-factors in Yb isotopes, 15:4103 (RA;DE)

YTTRIUM
First-principles total-energy calculations on Y and α-$YH_{0.5}$, 15:2889 (J;US)
Study for the determination of samarium, europium,terbium, dysprosium and yttrium in gadolinium oxide matrix by means of atomic absorption spectrophotometry using a graphite furnace, 15:3058 (R;BR;In Portuguese)

YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES
YTTRIUM COMPOUNDS

YTTRIUM COMPOUNDS
See also YTTRIUM HYDRIDES
YTTRIUM OXIDES
Electron-positron momentum distribution measurements of high-T superconductors and related systems, 15:4258 (R;US)
Electronic materials high-T_c superconductivity polymers and composites structural materials surface science and catalysts industry participation: Annual report, 1988, 15:2923 (R;US)
Fermi surfaces by positron annihilation in $YBa_2Cu_3O_x$, 15:4255 (R;US)
Processing and fabrication of high-temperature oxide superconductors. Annual report, 1 August 1988-30 June 1989, 15:2897 (R;US)
The possible occurrence of multi-phase behavior in the high T_c superconductor $YBa_2Cu_3O_x$, 15:4249 (R;US)

YTTRIUM HYDRIDES
First-principles total-energy calculations on Y and α-$YH_{0.5}$, 15:2889 (J;US)

YTTRIUM OXIDES
^{17}O nuclear-magnetic-resonance spectroscopic study of high-T_c superconductors, 15:2957 (J;US)
Anisotropy of oxygen tracer diffusion in $YBa_2Cu_3O_{7-\delta}$ single crystals, 15:2914 (R;US)
Creep of chromia and yttria-doped chromia, 15:2902 (R;US)
Dissipation measurement in high T_c superconductors with electromagnetic probes, 15:2916 (R;US)
Effect of heat treatment time and temperature of the properties of $YBa_2Cu_3O_{7-x}$, 15:2945 (J;US)
Ion implantation of sputtered Y-Ba-Cu-O films, 15:2951 (J;US)
Linear electron-hole-electron pair model of high-temperature superconductivity in $La_{2-x}M_xCuO_4$ and $YBa_2Cu_3O_{7-y}$: 2, Dependence of the superconducting transition temperatures on pressure and on hole concentration, 15:4251 (R;US)
Local atomic displacements in high T_c oxides studied by pulsed neutron scattering, 15:2905 (R;US)
Mean-field theory of oxygen-vacancy ordering in $YBa_2Cu_3O_{7-\delta}$, 15:2961 (J;US)
Microstructures of Y123 films on $SrTiO_3$, $LaGaO_3$ and $LaAlO_3$, 15:2922 (R;US)
States of partial order in $YBa_2Cu_3O_z$, 15:2948 (J;US)
[Dynamics of magnetic fluctuations in high-T_c materials]: Foreign trip report, October 5–October 15, 1989, 15:4257 (R;US)

YUCCA MOUNTAIN
Evaluation of the post-emplacement environment of high level radioactive waste packages at Yucca Mountain, Nevada (Yucca Mountain project), 15:2239 (R;US)

Preliminary integrated calculation of radionuclide cation and anion transport at Yucca Mountain using a geochemical model, 15:2204 (R;US)

Z

Z CODES
Abstract for Zeiss editor presentation, 15:4524 (R;US)
Z NEUTRAL BOSONS
B physics at the Z^0 pole, 15:3966 (R;US)
Flavor-changing decays of the Z^0 and leptoquarks, 15:4015 (J;US)
Z PINCH DEVICES (LINEAR)
See LINEAR Z PINCH DEVICES
ZEA MAYS
See MAIZE
ZEOLITES
Electron microscopy study of morphology and composition of a ferrisilicate catalyst, 15:2989 (BA;US)
High resolution electron microscopic study of the growth of denser phases on zeolite Y and zeolite L, 15:2935 (BA;US)
Investigation of the formation and chemical aspects of coke deposits occurring on acid, monofunctional zeolite catalysts through typical reactions with hydrocarbons, 15:2270 (R;DE;In German)
Key chemicals from synthesis gas - development of novel zeolites as catalysts for conversion of methanol into hydrocarbons, 15:2028 (R;DE;In German)
ZINC
Attempted use of zinc in vivo to protect against nitrogen mustard toxicity in tumor-free and in L1210 leukemia-bearing $B6D2F_1$ mice, 15:3764 (R;US)
Biological materials residues from pressurized decomposition with nitric acid. Identification of reaction products and their impact on inverse voltammetric element analysis, 15:3062 (R;DE;In German)
Comment on "Self-similarity of diffusion-limited aggregates and electrodeposition clusters", 15:2880 (J;US)
Health-hazard evaluation report HETA-88-244-1951, Orrville Bronze and Aluminum Company, Orrville, Ohio, 15:3457 (R;US)
Nucleation and propagation of cracks at grain boundaries in zinc bicrystals, 15:2875 (J;US)
The secondary slurry-zinc/air battery: Final report, 15:2579 (R;US)
Zinc electrode and rechargeable zinc-air battery, 15:2589 (P;US)
ZINC 64 TARGET
Direct decay of giant resonances in medium-heavy nuclei, 15:4089 (RA;DE;In German)
ZINC ARSENIDES
Antiphase domain boundary formation in single-crystal chalcopyrite-structure $ZnGeAs_2$ grown on GaAs, 15:3013 (J;US)
ZINC CHLORIDES
Health-hazard evaluation report HETA 87-109-1950, North Riverside Fire Department, North Riverside, Illinois, 15:3458 (R;US)
ZINC OXIDES
Pore structure and reactivity changes in hot coal gas desulfurization sorbents: Technical progress report, July–September 1989, 15:2067 (R;US)
ZINC TELLURIDES
Lattice relaxation of *DX*-like donors in $Zn_xCd_{1-x}Te$, 15:3029 (J;US)
ZINC-AIR BATTERIES
The secondary slurry-zinc/air battery: Final report, 15:2579 (R;US)
Zinc electrode and rechargeable zinc-air battery, 15:2589 (P;US)
ZINC-BROMINE BATTERIES
Analysis of life cycle costs for electric vans with advanced battery systems, 15:2583 (B;US)
Development of advanced battery systems for vehicle applications, 15:2587 (B;US)
ZIRCONIUM 90 REACTIONS
Heavy ion induced transfer reactions with ^{232}Th by the Crystal Ball, 15:4115 (RA;DE;In German)
Investigation of many-phonon excitations in ^{232}Th, 15:4114 (RA;DE;In German)
ZIRCONIUM 90 TARGET
Quasielastic scattering of polarized ^{23}Na, 15:4097 (RA;DE;In German)
ZIRCONIUM 95
Zirconium nitrate preparation and analytical method of zirconium determination in extraction experiments. pt.1, 15:3043 (R;BR;In Portuguese)
ZIRCONIUM ALLOYS
Elastic instability during amorphization of intermetallic compounds by charged-particle beams, 15:2861 (BA;US)
Exploratory study of niobium, titanium, zirconium, and tantalum aluminides. Final report, 1 March 1988-31 May 1989, 15:2807 (R;US)
Ion-beam mixing and amorphization in Au/Zr bilayers, 15:2859 (BA;US)
Lattice dynamics of quenched diffuse ω phase in $Zr_{0.8}Nb_{0.2}$, 15:2884 (J;US)
Spin dynamics of amorphous $Fe_{90-x}Ni_xZr_{10}$, 15:2819 (R;US)
ZIRCONIUM OXIDES
Catalyst and reactor development for a liquid phase Fischer-Tropsch process: Final report for Task 2, 15:2262 (R;US)
High-temperature corrosion of heat exchanger materials, 15:2911 (R;US)
Measurements of complex permittivity of microwave substrates in the 20 to 300 K temperature range from 26.5 to 40.0 GHz, 15:2928 (R;US)
Solid oxide fuel cells electrodes based on IN_2O_3-$PRrO_{1.83}$-ZrO_2, 15:2659 (R;US)
Synthesis of oxide powders by plasma vaporization of solutions, 15:2938 (BA;US)

Contract Number Index

Numbers assigned to DOE contracts announced in documents in this publication are listed. Contract numbers are sorted alphanumerically and list the primary corporate author of the document cited, the citation number, and the report number or other document identification.

Contract No.	Abstract No.	Report No.
AC01-85FE60850	**General Sciences Corp., Laurel, MD (USA)**	
	15:2077	DOE/FE/60850–T1
AC01-86MA19117	**Delaurenti (Jordan), Inc., Dallas, TX (USA)**	
	15:4490	DOE/MA/19117–T1
AC01-87CE40762	**Solar Energy Research Inst., Golden, CO (USA)**	
	15:2118	DOE/CH/10093–57
AC01-88DP50066	**Science Applications International Corp., McLean, VA (USA)**	
	15:2803	DOE/DP/50066–T1
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	15:2107	BNL–43128
	15:2457	BNL–43367
	15:2496	BNL–43298
	15:2812	BNL–43108
	15:2903	BNL–42550-Rev.
	15:2904	BNL–43373
	15:3070	BNL–42573
	15:3071	BNL–43214
	15:3102	BNL–43464
	15:3258	BNL–43394
	15:3261	BNL–43281
	15:3283	BNL–43344
	15:3284	BNL–43348
	15:3285	CONF-890906–6
	15:3314	BNL–43347
	15:3315	BNL–43350
	15:3405	BNL–43127-Rev.
	15:3406	BNL–43361
	15:3600	BNL–43112
	15:3615	BNL–43086
	15:4070	BNL–42814
	15:4123	BNL–43385
	15:4204	BNL–43345
	15:4253	BNL–43372
	Clark Univ., Worcester, MA (USA)	
	15:4125	DOE/ER/40417–4
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications	
	15:2546	NUREG/CR–5364
	Nuclear Regulatory Commission, Washington, DC (USA). Office of Information Resources Management	
	15:2540	NUREG/CR–2907-Vol.8
	15:3904	CONF-871147–
	15:2890	Published article
	15:3011	Published article
	15:3031	Published article
	15:3035	Published article
	15:3087	Published article
	15:3472	Published article
	15:4053	Published article
	15:4172	Published article
	15:4176	Published article
	15:4239	Published article
	15:4240	Published article
	15:4247	Published article

Contract No.	Abstract No.	Report No.
AC02-76CH03000	**Fermi National Accelerator Lab., Batavia, IL (USA)**	
	15:3287	FNAL-TM–1623
	15:3288	FNAL-TM–1626
	15:3333	FNAL-TM–1620
	15:3619	FNAL-TM–1622
	15:3953	FNAL/C–89/207-E
	15:3986	FNAL/C–89/232-T
	15:4034	FNAL/C–89/163-T
	15:4491	FNAL/C–89/194
	15:4516	FNAL/C–89/172
AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
	15:4350	PPPL–2651
	15:4351	PPPL–2660
AC02-76ER00881	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	15:3357	SLAC-PUB–5066
	15:3015	Published article
	15:4014	Published article
AC02-76ER03069	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	15:3357	SLAC-PUB–5066
	15:4082	Published article
	15:4482	CONF-870457–
AC02-81ER60015	**New York Univ., NY (USA)**	
	15:3760	DOE/ER/60015–7
AC02-83CH10093	**Solar Energy Research Inst., Golden, CO (USA)**	
	15:2304	SERI/STR–211-3582
	15:2305	SERI/STR–211-3583
	15:2306	SERI/STR–211-3585
	15:2308	SERI/TP–211-3595
	15:2384	SERI/TP–257-3591
	15:2700	SERI/CP–254-3000
	15:2118	DOE/CH/10093–57
	15:2303	SERI/STR–211-3410
	15:2307	SERI/STR–211-3586
	15:2383	SERI/STR–257-3479
AC02-85ER40193	**Iowa State Univ. of Science and Technology, Ames, IA (USA)**	
	15:3949	DOE/ER/40193–T3
AC03-76SF00098	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	15:3277	SLAC-PUB–5060
	California Univ., Berkeley, CA (USA). Dept. of Chemical Engineering	
	15:2109	DOE/SF/00098–T14
	Lawrence Berkeley Lab., CA (USA)	
	15:2105	LBL–27846
	15:2111	LBL–27729
	15:2205	LBL–24805-Rev.
	15:2206	LBL–26703
	15:2207	LBL–26704
	15:2208	LBL–26780
	15:2209	LBL–26827
	15:2210	LBL–26828
	15:2211	LBL–27225
	15:2212	LBL–27429

Contract No.	Abstract No.	Report No.
	15:2355	LBL–26612-Vol.1
	15:2356	LBL–26612-Vol.2
	15:2578	LBL–27037
	15:2609	LBL-PUB–630-Rev./10-89
	15:2622	LBL–27289
	15:2624	LBL–27131
	15:2631	LBL–25674-Rev.
	15:2635	LBL–27450
	15:2636	LBL–27748
	15:2646	LBL–22642
	15:2685	LBL–20090
	15:2686	LBL–20332
	15:2687	LBL–20333
	15:2688	LBL–20645
	15:2689	LBL–27140
	15:2690	LBL–27534
	15:2691	LBL–27692
	15:2840	LBL–27380
	15:2841	LBL–27834
	15:2923	LBL–27657
	15:3077	LBL–27937
	15:3078	LBL–27938
	15:3079	LBL–27940
	15:3096	LBL–26906
	15:3108	LBL–27904
	15:3109	LBL–27916
	15:3129	LBL–27627
	15:3130	LBL–27746
	15:3131	LBL–27826
	15:3259	LBL–27000
	15:3264	LBL–27001
	15:3265	LBL–27649
	15:3266	LBL–27763
	15:3272	LBL–27765
	15:3273	LBL–27766
	15:3299	LBL–21520
	15:3300	LBL–26248
	15:3301	LBL–26842
	15:3302	LBL–26843
	15:3303	LBL–26844
	15:3304	LBL–27339
	15:3305	LBL–27421
	15:3306	LBL–27606
	15:3307	LBL–27664
	15:3354	LBL–27813
	15:3498	LBL–27226
	15:3677	LBL–27919
	15:3745	LBL–27918
	15:3802	LBL–27867
	15:3811	LBL–26362
	15:3812	LBL–27778
	15:3828	LBL–27747
	15:3891	LBL–27423
	15:3960	LBL–27599
	15:4023	LBL–27452
	15:4066	LBL–27833
	15:4067	LBL–27885
	15:4099	LBL–27894
	15:4120	LBL–27878
	15:4161	LBL–27874
	15:4162	LBL–27881
	15:4233	LBL–25790
	15:4234	LBL–26490
	15:4235	LBL–27806
	15:4438	LBL–27230
	15:4439	LBL–27743
	15:4520	LBL–26796
	15:4521	LBL–27680
	15:4541	LBL–24121
	15:4542	LBL–25337
	15:4543	LBL–26600
	15:2579	LBL–27466
	15:2961	Published article
	15:3010	Published article
	15:3086	Published article
	15:3098	Published article
	15:3375	Published article
	15:3606	Published article
	15:3794	Published article
	15:3880	Published article
	15:4026	Published article
	15:4031	Published article
	15:4171	Published article
AC03-76SF00515	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	15:3276	SLAC/AP–76
	15:3277	SLAC-PUB–5060
	15:3278	SLAC-PUB–5086
	15:3309	SLAC-TN–89-1
	15:3310	SLAC-TN–89-2
	15:3357	SLAC-PUB–5066
	15:3962	SLAC–343
	15:3963	SLAC–347
	15:3964	SLAC–350
	15:3965	SLAC-PUB–4984
	15:3966	SLAC-PUB–5048
	15:3967	SLAC-PUB–5118
	15:3015	Published article
	15:4013	Published article
	15:4016	Published article
	15:4025	Published article
	15:4050	Published article
AC03-76SF00700	**Rockwell International Corp., Canoga Park, CA (USA). Energy Technology Engineering Center**	
	15:2710	NASA-CR–185163
	15:2960	Published article
AC03-89ER51114	**General Atomics Co., San Diego, CA (USA)**	
	15:4409	GA-A–19741
	General Atomics, San Diego, CA (USA)	
	15:4407	GA-A–19739
	15:4408	GA-A–19740
	15:4410	GA-A–19742
	15:4411	GA-A–19747
	15:4412	GA-A–19748
	15:4413	GA-A–19751
	15:4414	GA-A–19752
	15:4415	GA-A–19756
AC03-89ER53277	**General Atomics, San Diego, CA (USA)**	
	15:4312	GA-A–19860
AC04-76DP00613	**Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.**	
	15:3063	KCP–613-4127
AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	15:2233	SAND–88-2535
	15:2234	SAND–88-2626C
	15:2235	SAND–88-2734
	15:2236	SAND–89-0386
	15:2260	SAND–89-0917
	15:2360	SAND–89-0567
	15:2476	SAND–89-1755C
	15:2612	SAND–89-1832
	15:2852	SAND–89-1665C
	15:2853	SAND–89-1711C
	15:3081	SAND–89-0691
	15:3138	SAND–89-0319C
	15:3139	SAND–89-1485
	15:3220	SAND–89-2198C
	15:3226	SAND–89-0500
	15:3227	SAND–89-2542C
	15:3274	SAND–89-2629C
	15:3275	SAND–89-7141C

Contract No.	Abstract No.	Report No.
	15:3381	SAND–89-1437C
	15:3389	SAND–86-2189C
	15:3815	SAND–89-1508
	15:3894	SAND–89-1685
	15:3895	SAND–89-2668C
	15:4288	SAND–89-2525C
	15:4527	SAND–89-2533C
	15:2301	SAND–89-7036
	15:2302	SAND–89-7039
	15:3308	SAND–89-7106
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research	
	15:2541	NUREG/CR–5215
	15:2857	CONF-8711126–
	15:2117	Published article
	15:2474	Published article
	15:2886	Published article
	15:2963	Published article
	15:3004	Published article
	15:3008	Published article
	15:3009	Published article
	15:3022	Published article
	15:3094	Published article
	15:3906	Published article
	15:4245	Published article
	15:4260	Published article
AC04-76DP03533	**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**	
	15:2985	RFP–4377
	15:3465	RFP–4376
	15:4524	RFP–4368
AC04-86AL31950	**Westinghouse Electric Corp., Carlsbad, NM (USA)**	
	15:2189	DOE/WIPP–89-007
	Westinghouse Electric Corp., Carlsbad, NM (USA). Engineering and Repository Technology Dept.	
	15:2190	DOE/WIPP–89-009-Vol.1
	15:2191	DOE/WIPP–89-009-Vol.2
	Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.	
	15:2192	DOE/WIPP–89-014
AC04-88DP43495	**EG and G Mound Applied Technologies, Miamisburg, OH (USA)**	
	15:3380	MLM–3612(OP)
AC05-76OR00001	**Martin Marietta Energy Systems, Inc., Piketon, OH (USA)**	
	15:2419	POEF-M–19
	15:3088	Published article
AC05-84ER40150	**Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility**	
	15:3948	DOE/ER/40150–89
	15:3015	Published article
AC05-84OR21400	**International Atomic Energy Agency, Vienna (Austria)**	
	15:2528	IAEA-SM–310/63P
	Oak Ridge National Lab., TN (USA)	
	15:2018	CONF-891079–1
	15:2064	ORNL/FTR–3458
	15:2065	ORNL/FTR–3459
	15:2170	ORNL/TM–11023
	15:2181	CONF-891197–2
	15:2184	CONF-8910239–3
	15:2220	ORNL/FTR–3457
	15:2259	ORNL/tr–89/42
	15:2409	CONF-891113–6
	15:2429	ORNL/FTR–3473
	15:2437	CONF-8910222–5
	15:2455	ORNL/FTR–3420
	15:2472	ORNL/tr–89/40
	15:2473	ORNL/tr–89/46
	15:2479	CONF-8910222–6
	15:2481	ORNL/FTR–3451
	15:2492	ORNL/TM–11335
	15:2510	CONF-8910222–3
	15:2511	CONF-8910222–4
	15:2512	CONF-8910239–5
	15:2553	ORNL/FTR–3437
	15:2593	CONF-8911117–1
	15:2594	ORNL/FTR–3439
	15:2610	ORNL/PPA–89/1
	15:2632	CONF-8909242–1
	15:2633	CONF-8909242–2
	15:2673	DOE/HWP–94
	15:2693	ORNL–6487
	15:2819	CONF-891117–8
	15:2820	CONF-8707219–1
	15:2830	DOE/OR/21400–T401
	15:2907	CONF-891119–4
	15:2908	CONF-891119–6
	15:2911	CONF-8910120–1
	15:2912	CONF-8910120–3
	15:2913	CONF-8910248–1
	15:2930	ORNL/FTR–3107
	15:2931	ORNL/FTR–3445
	15:2979	ORNL/FTR–3089
	15:3073	CONF-891013–7
	15:3125	CONF-891103–44
	15:3215	CONF-8905112–3
	15:3422	ORNL/FTR–3424
	15:3423	ORNL/FTR–3429
	15:3424	ORNL/FTR–3434
	15:3425	ORNL/FTR–3449
	15:3426	ORNL/FTR–3452
	15:3427	ORNL/TM–11120
	15:3483	ORNL/TM–11329
	15:3499	ORNL/FTR–3455
	15:3508	ORNL/RASA–87/36
	15:3509	ORNL/RASA–88/18
	15:3510	ORNL/RASA–88/30
	15:3511	ORNL/RASA–89/5
	15:3512	ORNL/RASA–89/7
	15:3513	ORNL/RASA–89/8
	15:3514	ORNL/RASA–89/9
	15:3693	CONF-8909236–2
	15:3746	ORNL–6579
	15:3747	ORNL/FTR–3415
	15:3765	ORNL/M–948
	15:4101	CONF-890902–20
	15:4257	ORNL/FTR–3446
	15:4301	CONF-891106–3
	15:4304	CONF-8910259–1-Vugraphs
	15:4387	CONF-891007–31
	15:4388	CONF-891007–72
	15:4389	CONF-891007–75
	15:4390	CONF-891007–77
	15:4391	CONF-891007–78
	15:4392	CONF-891007–83
	15:4394	CONF-891007–85
	15:4395	CONF-891007–88
	15:4396	CONF-891093–9
	15:4397	CONF-8905112–2
	15:4511	CONF-8910284–1
	Environmental Protection Agency, Washington, DC (USA)	
	15:3758	CONF-890422–1
	Oak Ridge National Lab., TN (USA). Hazwrap Support Contractor Office	
	15:3801	CONF-8910193–4

Contract No.	Abstract No.	Report No.
	15:3002	CONF-871147–
	15:3174	CONF-871147–
	15:3176	CONF-871147–
	15:3903	CONF-871147–
	15:3899	CONF-8805213–
	15:2874	Published article
	15:2878	Published article
	15:2959	Published article
	15:3012	Published article
	15:3019	Published article
	15:3023	Published article
	15:3025	Published article
	15:3088	Published article
	15:3211	Published article
	15:3376	Published article
	15:3396	Published article
	15:3923	Published article
	15:4166	Published article
	15:4176	Published article
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div.**	
	15:2249	K/ITP–111
AC05-86OR21548	**MK-Ferguson Co., St. Charles, MO (USA)**	
	15:2242	DOE/OR/21548–045-Rev.0
AC06-76RL01830	**Hanford Works, Richland, WA (USA)**	
	15:2527	HW–34461
	15:3503	HW–33128
	15:3548	HW–32809
	Battelle Pacific Northwest Lab., Richland, WA (USA)	
	15:2166	BNWL-CC–2048
	General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation	
	15:3504	HW–39558
	Pacific Northwest Lab., Richland, WA (USA)	
	15:2225	PNL–7130
	15:2226	PNL-SA–16209
	15:2227	PNL-SA–16734
	15:2228	PNL-SA–16826
	15:2229	PNL-SA–16844
	15:2230	PNL-SA–17164-HEDR
	15:2231	PNL-SA–17267
	15:2232	PNL-SA–17359
	15:2243	PNL–6972
	15:2381	PNL-SA–17250
	15:2440	PNL–6732
	15:2598	PNL-SA–16875
	15:2615	PNL-SA–16907
	15:2659	PNL-SA–17036
	15:2698	PNL–6984
	15:2699	PNL-SA–17311
	15:2753	PNL-SA–16968
	15:2849	PNL-SA–17443
	15:3371	PNL-SA–17257
	15:3462	PNL–7163
	15:3463	PNL–7166
	15:3464	PNL-SA–17385
	15:3488	PNL-SA–17367
	15:3501	PNL-SA–16809
	15:3515	PNL-SA–16766
	15:3517	PNL–6982
	15:3541	PNL–7103
	15:3748	PNL-SA–16690
	15:3749	PNL-SA–16859-HEDR
	15:3750	PNL-SA–16874-HEDR
	15:3751	PNL-SA–17026
	15:3819	PNL-SA–17111
	15:4195	PNL–7124
	15:4495	PNL-SA–17004
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Computer and Telecommunications Services	
	15:2539	NUREG/CR–2850-Vol.8
	15:3921	Published article
AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (USA)**	
	15:2171	WHC-SA–0616
	15:4532	WHC-SA–0726
AC07-76ID01570	**Argonne National Lab., IL (USA)**	
	15:4107	CONF-890686–3
	EG and G Idaho, Inc., Idaho Falls, ID (USA)	
	15:2062	EGG-M–88261
	15:2063	EGG-M–88469
	15:2186	DOE/ID–10233(88)
	15:2193	EGG-M–88181
	15:2354	EGG-EP–8708
	15:2357	EGG-M–88264
	15:2480	EGG-M–88288
	15:2485	EGG-M–34487
	15:2486	EGG-M–88154
	15:2490	EGG-M–88270
	15:2516	EGG-EAST–8546
	15:2517	EGG-M–32787
	15:2518	EGG-M–36787
	15:2519	EGG-M–88156
	15:2520	EGG-M–88163
	15:2521	EGG-M–88275
	15:2522	EGG-M–88300
	15:2523	EGG-M–88428
	15:2524	EGG-M–88438
	15:2576	DOE/ID–10243
	15:2577	EGG-M–88115
	15:2727	EGG-M–36387
	15:2728	EGG-M–89322
	15:2790	DOE/ID–10219
	15:2791	DOE/ID–10252
	15:2792	EGG-M–89258
	15:2793	EGG-M–89361
	15:2831	EGG-M–37087
	15:2832	EGG-M–88357
	15:2833	EGG-M–88501
	15:2834	EGG-M–89209
	15:2915	EGG-M–89119
	15:2916	EGG-M–89153
	15:3126	EGG-HFRU–8654
	15:3127	EGG-M–88271
	15:3546	EGG-M–88376
	15:3609	EGG-M–88477
	15:3807	EGG-M–89182
	15:3808	EGG-M–89193
	15:3937	EGG-M–38887
	15:4404	EGG-M–36587
	15:4405	EGG-M–88260
	15:4406	EGG-M–88268
	15:4514	EGG-M–88277
	15:4515	EGG-M–89380
	15:4540	EGG-M–89437
	15:2194	EGG-M–89302
	15:2438	EGG-M–89186
	15:2515	DOE/ID–10216-Vol.6
	15:2658	EGG-EP–8581
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution	
	15:2542	NUREG/CR–5225
AC07-82ID12356	**EG and G Idaho, Inc., Idaho Falls, ID (USA)**	
	15:2277	EGG-M–89101

Contract No.	Abstract No.	Report No.
AC07-88ID12698	EG and G Idaho, Inc., Idaho Falls, ID (USA)	
	15:2194	EGG-M–89302
AC08-89NV10630	Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)	
	15:4185	CONF-890619–9
AC09-89SR18035	Westinghouse Savannah River Co., Aiken, SC (USA)	
	15:2165	WSRC-RP–89-355
	15:2756	WSRC-tr–122
	15:2757	WSRC-tr–123
AC21-85MC22123	General Motors Corp., Indianapolis, IN (USA). Allison Gas Turbine Div.	
	15:2798	DOE/MC/22123–2735-Vol.1
	15:2799	DOE/MC/22123–2735-Vol.2
AC21-86MC23140	Columbia Gas System Service Corp., Columbus, OH (USA)	
	15:2138	DOE/MC/23140–2695
AC21-88MC25009	Energy Research Corp., Danbury, CT (USA)	
	15:2657	DOE/MC/25009–2752
AC21-89MC25151	North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center	
	15:2095	DOE/MC/25151–2745
AC22-80PC30021	Air Products and Chemicals, Inc., Allentown, PA (USA)	
	15:2261	DOE/PC/30021–T20
	15:2262	DOE/PC/30021–T21
	15:2263	DOE/PC/30021–T22
AC22-86PC90014	UOP, Inc., Des Plaines, IL (USA)	
	15:2264	DOE/PC/90014–T2
	15:2265	DOE/PC/90014–T3
AC22-87PC79680	Montana State Univ., Bozeman, MT (USA). Dept. of Electrical Engineering	
	15:2648	DOE/PC/79680–T2
AC22-87PC79902	Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.	
	15:2096	DOE/PC/79902–T1
AC22-87PC90274	TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.	
	15:2649	DOE/PC/90274–T6
AC22-88PC88812	Colorado School of Mines, Golden, CO (USA). Dept. of Chemical Engineering and Petroleum Refining	
	15:2022	DOE/PC/88812–T5
AC22-88PC88813	Western Research Inst., Laramie, WY (USA)	
	15:2023	DOE/PC/88813–T4
AC22-88PC88868	Southern Research Inst., Birmingham, AL (USA)	
	15:2423	DOE/PC/88868–T3
AC22-88PC88874	Acurex Corp., Research Triangle Park, NC (USA). Environmental Systems Div.	
	15:2424	DOE/PC/88874–T6
AC22-88PC88877	Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering	
	15:2015	DOE/PC/88877–T3
AC22-88PC88881	Kaiser Engineers, Inc., Pittsburgh, PA (USA)	
	15:2016	DOE/PC/88881–T4
AC22-88PC88886	Western Research Inst., Laramie, WY (USA)	
	15:2017	DOE/PC/88886–T4
AC22-88PC88947	Cornell Univ., Ithaca, NY (USA)	
	15:2084	DOE/PC/88947–T4
AC79-83BP11287	Pacific Power and Light Co., Portland, OR (USA)	
	15:2670	DOE/BP/11287–12
AI01-86CE50162	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
	15:2783	DOE/NASA–0352-3
AI01-86ER13471	National Bureau of Standards, Washington, DC (USA). Chemical Kinetics Div.	
	15:3107	DOE/ER/13471–T2
AI09-85SR14069	Forest Service, Aiken, SC (USA). Southeastern Forest Experiment Station	
	15:3492	DOE/SR/14069–2
AI22-88PC88561	Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center	
	15:2014	DOE/PC/88561–T1
AI79-83BP12659	USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife	
	15:2278	DOE/BP/12659–5
AI79-83BP39643	National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.	
	15:2280	DOE/BP/39643–3
AI79-85BP23169	Oregon State Univ., Corvallis, OR (USA). Dept. of Electrical and Computer Engineering	
	15:3224	DOE/BP/23169–2
AI79-87BP35245	Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center	
	15:2279	DOE/BP/35245–2
AI79-87BP35571	Colorado State Univ., Fort Collins, CO (USA)	
	15:2724	DOE/BP/35571–1
AI79-87BP65903	USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife	
	15:2281	DOE/BP/65903–2
	15:4025	Published article
AS03-83ER40120	Lawrence Livermore National Lab., CA (USA)	
	15:4353	UCRL–21248
AS05-76ER03956	Tennessee Univ., Knoxville, TN (USA). Dept. of Physics	
	15:3978	DOE/ER/03956–T4
AS05-77ER05490	Louisiana State Univ., Baton Rouge, LA (USA)	
	15:3944	DOE/ER/05490–107
AS05-80ER10742	Brookhaven National Lab., Upton, NY (USA)	
	15:2903	BNL–42550-Rev.
FC07-81ID12170	EG and G Idaho, Inc., Idaho Falls, ID (USA)	
	15:2727	EGG-M–36387
FC22-83FE60149	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
	15:2112	NIPER–417
	15:2113	NIPER–438
	15:2114	NIPER–443
FC22-87PC79796	Energy and Environmental Research Corp., Irvine, CA (USA)	
	15:2422	DOE/PC/79796–T7
FC22-89PC89904	Southern Illinois Univ., Carbondale, IL (USA). Coal Extraction and Utilization Research Center	
	15:2058	DOE/PC/89904–T4
FG01-86CE64615	New Mexico Energy and Minerals Dept., Santa Fe, NM (USA)	
	15:2621	DOE/CE/64615–T2-Exec.Summ.

Contract No.	Abstract No.	Report No.
FG01-88CE27489	American Council for an Energy-Efficient Economy, Washington, DC (USA)	
	15:2620	CONF-8808273–Vol.7
FG01-89CE15407	Harmony Thermal Co., Wichita, KS (USA)	
	15:2671	DOE/CE/15407–T2
	15:2725	DOE/CE/15407–T1
FG01-89CE15449	Instatherm Co., Cary, NC (USA)	
	15:2563	DOE/CE/15449–T1
FG02-84ER13277	Utah Univ., Salt Lake City, UT (USA). Dept. of Fuels Engineering	
	15:2828	DOE/ER/13277–T2
FG02-84ER13295	Pennsylvania State Univ., University Park, PA (USA)	
	15:3074	DOE/ER/13295–3
FG02-85ER45182	Denver Univ., CO (USA). Dept. of Physics	
	15:2829	DOE/ER/45182–5
FG02-85ER45199	Purdue Research Foundation, Lafayette, IN (USA)	
	15:4212	DOE/ER/45199–T2
FG02-85ER45200	Purdue Research Foundation, Lafayette, IN (USA)	
	15:4212	DOE/ER/45199–T2
FG02-85ER53208	Lawrence Livermore National Lab., CA (USA)	
	15:3897	UCRL–21257
FG02-85ER60294	Pennsylvania State Univ., University Park, PA (USA)	
	15:3410	DOE/ER/60294–T1
FG02-86CE34002	Colorado Univ., Boulder, CO (USA)	
	15:3225	DOE/CE/34002–1
FG02-86ER40266	Wisconsin Univ., Madison, WI (USA). Dept. of Physics	
	15:3286	DOE/ER/40266–2
FG02-86ER40281	Columbia Univ., New York, NY (USA)	
	15:4108	DOE/ER/40281–4
FG02-86ER52127	Illinois Univ., Urbana, IL (USA)	
	15:4302	CONF-8901166–1
	15:4398	CONF-8906236–1
FG02-86ER53223	New York Univ., NY (USA)	
	15:4306	DOE/ER/53223–T2
	New York Univ., NY (USA). Courant Inst. of Mathematical Sciences	
	15:4305	DOE/ER/53223–118
FG02-86ER60431	Utah Univ., Salt Lake City, UT (USA)	
	15:3545	DOE/ER/60431–3
FG02-87ER13695	Colorado Univ., Boulder, CO (USA). Dept. of Chemistry and Biochemistry	
	15:3095	DOE/ER/13695–T1
FG02-87ER13732	Pennsylvania Univ., Philadelphia, PA (USA)	
	15:2970	DOE/ER/13732–2
FG02-87ER13777	Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Chemical Engineering	
	15:2054	DOE/ER/13777–2
FG02-87ER40346	Argonne National Lab., IL (USA)	
	15:4107	CONF-890686–3
FG02-87ER60549	New York Univ., NY (USA). Dept. of Environmental Medicine	
	15:3412	DOE/ER/60549–3
	15:3413	DOE/ER/60549–4
FG02-87ER60555	Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory	
	15:3817	DOE/ER/60555–3
FG02-87ER60561	Michigan Univ., Ann Arbor, MI (USA). Div. of Nuclear Medicine	
	15:3616	DOE/ER/60561–T1
FG02-88ER13855	State Univ. of New York, Stony Brook, NY (USA). Dept. of Chemistry	
	15:3075	DOE/ER/13855–2
	15:3933	Published article
FG02-88ER40389	Pennsylvania Univ., Philadelphia, PA (USA). Dept. of Physics	
	15:3984	DOE/ER/40389–54
	Temple Univ., Philadelphia, PA (USA). Dept. of Physics	
	15:3332	DOE/ER/40389–57
	15:3950	DOE/ER/40389–61
	15:3951	DOE/ER/40389–62
	15:4083	DOE/ER/40389–56
FG02-88ER40405	Minnesota Univ., Minneapolis, MN (USA). Dept. of Physics and Astronomy	
	15:4064	DOE/ER/40405–T2
FG02-88ER40416	Valparaiso Univ., IN (USA)	
	15:3952	DOE/ER/40416–2
FG02-88ER40417	Clark Univ., Worcester, MA (USA)	
	15:4125	DOE/ER/40417–4
FG02-88ER40434	Connecticut Univ., Storrs, CT (USA)	
	15:3942	CONF-8808145–
FG02-88ER53263	Lodestar Research Corp., Boulder, CO (USA)	
	15:4307	DOE/ER/53263–7
FG02-88ER60631	Columbia Univ., New York, NY (USA). Coll. of Physicians and Surgeons	
	15:3694	DOE/ER/60631–2
	15:3695	DOE/ER/60631–T4
FG02-88ER60634	Nebraska Univ., Lincoln, NE (USA). Dept. of Physics	
	15:3617	DOE/ER/60634–1
FG02-88ER60655	Johns Hopkins Univ., Baltimore, MD (USA)	
	15:3414	DOE/ER/60655–2
	15:3607	Published article
FG03-85ER13334	California Univ., Riverside, CA (USA)	
	15:3601	CONF-8701163–
FG03-86ER52125	California Univ., Los Angeles, CA (USA)	
	15:4443	UCLA/PPG–1135
FG03-86SF16306	Colorado State Univ., Fort Collins, CO (USA). Solar Energy Applications Lab.	
	15:2332	DOE/SF/16306–18
FG03-87ER25028	Stanford Univ., CA (USA). Dept. of Operations Research	
	15:4529	SOL–89-16
	Stanford Univ., CA (USA). Systems Optimization Lab.	
	15:4528	SOL–89-15
	15:4548	SOL–89-14
FG03-87ER25030	Stanford Univ., CA (USA). Systems Optimization Lab.	
	15:4545	SOL–89-7
	15:4546	SOL–89-11
	15:4547	SOL–89-12
	15:3605	Published article
FG05-80ET53088	Texas Univ., Austin, TX (USA)	
	15:4309	DOE/ET/53088–401
	Texas Univ., Austin, TX (USA). Inst. for Fusion Studies	
	15:4308	DOE/ET/53088–370
	15:4310	DOE/ET/53088–407
FG05-85ER53192	Auburn Univ., AL (USA)	
	15:4399	DOE/ER/53192–40
FG05-85ER60301	Pittsburgh Univ., PA (USA). Pymatuning Lab. of Ecology	
	15:3539	DOE/ER/60301–10
	15:3933	Published article
	15:3026	Published article
	15:3027	Published article
FG05-86ER13581	Florida Univ., Gainesville, FL (USA)	
	15:3602	DOE/ER/13581–3
FG05-86ER13632	Louisiana State Univ., Baton Rouge, LA (USA). Dept. of Chemical Engineering	
	15:4211	DOE/ER/13632–3

Contract No.	Abstract No.	Report No.
FG05-86ER40273	Florida State Univ., Tallahassee, FL (USA). Dept. of Physics	
	15:4033	DOE/ER/40273–4
FG05-86ER45259	Argonne National Lab., IL (USA)	
	15:4251	ANL/PPRNT–89-197
FG05-87ER13711	Texas A and M Univ., College Station, TX (USA). Center for Tectonophysics	
	15:2358	DOE/ER/13711–1
FG05-87ER60588	Florida State Univ., Tallahassee, FL (USA). Inst. of Molecular Biophysics	
	15:3761	DOE/ER/60588–3
FG05-88ER13897	Texas Univ., Austin, TX (USA). Center for Studies in Statistical Mechanics	
	15:4262	DOE/ER/13897–10
FG05-88ER25068	Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA)	
	15:4508	CONF-8903169–2
	Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Dept. of Computer Science	
	15:4513	DOE/ER/25068–1
FG05-88ER60647	Old Dominion Univ., Norfolk, VA (USA). Research Foundation	
	15:3818	DOE/ER/60647–2
FG05-88ER60692	Baylor Univ., Houston, TX (USA). Inst. of Molecular Genetics	
	15:3603	DOE/ER/60692–2
FG06-85ER40224	Oregon Univ., Eugene, OR (USA)	
	15:3319	DOE/ER/40224–86
	15:3330	DOE/ER/40224–87
	15:3945	DOE/ER/40224–85
	15:3980	DOE/ER/40224–91
	Oregon Univ., Eugene, OR (USA). Dept. of Physics	
	15:3981	DOE/ER/40224–108
	Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science	
	15:3331	DOE/ER/40224–129
	15:3979	DOE/ER/40224–90
	15:3982	DOE/ER/40224–110
	15:3983	DOE/ER/40224–114
	15:4017	DOE/ER/40224–115
FG06-85ER60313	Oregon Graduate Center, Beaverton, OR (USA). Inst. of Atmospheric Sciences	
	15:3411	DOE/ER/60313–4
FG06-86ER13472	Washington Univ., Seattle, WA (USA)	
	15:3805	DOE/ER/13472–3
FG06-88ER40427	Washington Univ., Seattle, WA (USA). Dept. of Physics	
	15:3985	DOE/ER/40427–11-N9
	15:4018	DOE/ER/40427–13-N9
	15:4019	DOE/ER/40427–14-N9
	15:4126	DOE/ER/40427–09-N9
	15:4127	DOE/ER/40427–12-N9
	Washington Univ., Seattle, WA (USA). Inst. for Nuclear Theory	
	15:4128	DOE/ER/40427–20-N9
FG21-85LC11066	Alabama Univ., University, AL (USA). Mineral Resources Inst.	
	15:2155	DOE/LC/11066–2719-Vol.1
FG21-86LC11075	Alaska Univ., Fairbanks, AK (USA). Petroleum Development Lab.	
	15:2156	DOE/LC/11075–2737
FG22-86PC90519	New Mexico Univ., Albuquerque, NM (USA). Dept. of Chemistry	
	15:2059	DOE/PC/90519–T11
FG22-86PC90521	North Dakota Univ., Grand Forks, ND (USA). Dept. of Physics	
	15:2060	DOE/PC/90521–T12
FG22-86PC90527	Pittsburgh Univ., PA (USA). Dept. of Chemistry	
	15:2061	DOE/PC/90527–T8
FG22-86PC90910	Pennsylvania State Univ., University Park, PA (USA). Energy and Fuels Research Center	
	15:2026	DOE/PC/90910–T1
FG22-86PC91101	Virginia Commonwealth Univ., Richmond, VA (USA). Dept. of Chemistry	
	15:2068	DOE/PC/91101–T8
FG22-87PC79906	Alabama A and M Univ., Normal, AL (USA)	
	15:2097	DOE/PC/79906–T2
FG22-87PC79921	Rochester Univ., NY (USA). Dept. of Chemical Engineering	
	15:2067	DOE/PC/79921–T6
FG22-87PC79926	Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry	
	15:2019	DOE/PC/79926–6
	15:2020	DOE/PC/79926–7
FG22-87PC79933	Utah Univ., Salt Lake City, UT (USA)	
	15:2021	DOE/PC/79933–8
FG22-88PC88900	Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.	
	15:2098	DOE/PC/88900–5
FG22-88PC88917	Florida Univ., Gainesville, FL (USA)	
	15:2024	DOE/PC/88917–T2
FG22-88PC88922	Illinois Univ., Urbana, IL (USA). Dept. of Chemical Engineering	
	15:2055	DOE/PC/88922–4
FG22-88PC88934	USDOE Pittsburgh Energy Technology Center, PA (USA)	
	15:2056	DOE/PC/88934–T3
FG22-88PC88935	Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences	
	15:2025	DOE/PC/88935–T3
FG22-88PC88939	Utah Univ., Salt Lake City, UT (USA). Dept. of Mining Engineering	
	15:2083	DOE/PC/88939–5
FG22-88PC88941	West Virginia Univ., Morgantown, WV (USA). Dept. of Mechanical and Aerospace Engineering	
	15:2057	DOE/PC/88941–T4
	15:2873	Published article
	15:2887	Published article
	15:2947	Published article
	15:2952	Published article
	15:2953	Published article
	15:2958	Published article
	15:3030	Published article
	15:3091	Published article
	15:3358	Published article
	15:3908	Published article
	15:3913	Published article
	15:3927	Published article
	15:3928	Published article
	15:3934	Published article
	15:4005	Published article
	15:4006	Published article
	15:4244	Published article
	15:4297	Published article
W-31109-ENG-38	Argonne National Lab., Idaho Falls, ID (USA)	
	15:2460	CONF-8910239–4
	15:2478	CONF-890555–23
	Argonne National Lab., IL (USA)	
	15:2013	CONF-8911107–1
	15:2051	CONF-891001–9
	15:2052	CONF-891001–10
	15:2053	CONF-891046–4
	15:2092	ANL/PPRNT–89-193
	15:2093	CONF-890437–13
	15:2094	CONF-8906246–1
	15:2164	CONF-8909141–5-Draft
	15:2180	CONF-891053–5

Contract No.	Abstract No.	Report No.
	15:2182	CONF-8906240–1
	15:2183	CONF-8906241–1
	15:2185	CONF-8911110–1
	15:2269	ANL/CNSV–69
	15:2420	CONF-8903173–1
	15:2421	CONF-8904289–1
	15:2432	ANL–88-37
	15:2442	CONF-8910274–2
	15:2458	CONF-8909141–3
	15:2459	CONF-891103–34
	15:2488	CONF-8909141–7
	15:2489	CONF-8909141–8
	15:2500	CONF-890673–5
	15:2501	CONF-890841–3
	15:2502	CONF-890841–4
	15:2503	CONF-890855–57
	15:2504	CONF-890855–58
	15:2505	CONF-890899–2
	15:2506	CONF-891140–3
	15:2507	CONF-891140–4
	15:2508	CONF-8907161–1
	15:2509	CONF-8909263–1
	15:2513	CONF-8910274–1
	15:2573	CONF-891132–7
	15:2574	CONF-891132–8
	15:2575	CONF-8905126–7
	15:2591	CONF-8909254–1
	15:2592	CONF-8911108–1
	15:2605	CONF-890659–3
	15:2654	CONF-891113–5
	15:2709	CONF-890790–3
	15:2758	ANL/PPRNT–89-188
	15:2759	CONF-8908177–1
	15:2794	ANL–89/28
	15:2821	CONF-8904290–1
	15:2822	CONF-8905188–2
	15:2823	CONF-8905239–1
	15:2824	CONF-8906247–1
	15:2825	CONF-8908175–1
	15:2902	ANL/PPRNT–89-189
	15:2905	CONF-890480–2
	15:2906	CONF-891036–2
	15:2909	CONF-8906119–4
	15:2910	CONF-8908133–7
	15:2914	CONF-8910273–1
	15:2968	CONF-880810–2
	15:2969	CONF-8908179–2
	15:3041	CONF-8910287–1
	15:3072	CONF-890756–3
	15:3187	CONF-8906112–2
	15:3213	CONF-890770–3
	15:3214	CONF-8806370–
	15:3260	ANL-HEP-CP–89-122
	15:3316	CONF-890826–5
	15:3317	CONF-8904281–1
	15:3318	CONF-8908170–2
	15:3365	CONF-8907113–13
	15:3366	CONF-8910216–3
	15:3404	ANL/PPRNT–89-183
	15:3407	CONF-890814–9
	15:3408	CONF-8906244–1
	15:3494	CONF-8906242–1
	15:3495	CONF-8906243–1
	15:3496	CONF-8907103–12
	15:3497	CONF-8911106–1
	15:3598	ANL/PPRNT–89-194
	15:3599	ANL/PPRNT–89-198
	15:3608	ANL/PPRNT–89-191
	15:3759	CONF-8910275–1
	15:3972	ANL-HEP-CP–89-69
	15:3973	ANL-HEP-CP–89-109
	15:3974	ANL-HEP-CP–89-112
	15:3975	ANL/PPRNT–89-192
	15:3977	CONF-8907127–3
	15:4081	ANL/PPRNT–89-196
	15:4107	CONF-890686–3
	15:4111	CONF-890982–5
	15:4124	CONF-8905143–19
	15:4203	ANL/PPRNT–89-190
	15:4205	CONF-890821–6
	15:4206	CONF-8904290–2
	15:4207	CONF-8904290–3
	15:4208	CONF-8908133–6
	15:4209	CONF-8910276–1
	15:4210	CONF-8911109–1
	15:4248	ANL/PPRNT–89-184
	15:4249	ANL/PPRNT–89-185
	15:4250	ANL/PPRNT–89-186
	15:4251	ANL/PPRNT–89-197
	15:4252	ANL/PPRNT–89-199
	15:4254	CONF-890939–2
	15:4255	CONF-8910282–1
	15:4261	CONF-8908179–1
	15:4303	CONF-8909257–1
	15:4393	CONF-891007–84
	15:4504	ANL–89/2-Rev.1
	15:4505	ANL/EES-TM–378
	15:4506	ANL/PPRNT–89-195
	15:4509	CONF-8904288–1
	15:4510	CONF-8908178–1
	15:4512	CONF-8910288–1
	15:4535	ANL/TM–474
	15:2945	Published article
	15:2946	Published article
W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	15:2201	LA-UR–89-3354
	15:2202	LA-UR–89-3355
	15:2203	LA-UR–89-3410
	15:2204	LA-UR–89-3503
	15:2246	LA-UR–89-3699
	15:2921	LA-UR–89-3616
	15:2922	LA-UR–89-4011
	15:3128	LA-UR–89-3331
	15:3155	LA–11567-MS
	15:3156	LA-UR–89-3394
	15:3157	LA-UR–89-3395
	15:3158	LA-UR–89-3406
	15:3159	LA-UR–89-3438
	15:3160	LA-UR–89-3581
	15:3271	LA-UR–89-3600
	15:3297	LA–11662-MS
	15:3298	LA-UR–89-3397
	15:3353	LA–11702-MS
	15:3378	LA-UR–89-3498
	15:3482	LA-UR–89-3431
	15:3744	LA–11652-MS
	15:3764	LA–11474
	15:3946	LA–11670-PR
	15:3959	LA-UR–89-3695
	15:4044	LA-UR–89-3537
	15:4073	LA-UR–89-3535
	15:4079	LA–11685-T
	15:4160	LA-UR–89-3638
	15:4231	LA-UR–89-3334
	15:4232	LA-UR–89-3361
	15:4256	LA-UR–89-3380
	15:4285	LA-UR–89-3337
	15:4286	LA-UR–89-3465
	15:4342	LA-UR–89-3174
	15:4428	LA-UR–89-1909
	15:4429	LA-UR–89-3068
	15:4430	LA-UR–89-3268
	15:4431	LA-UR–89-3275
	15:4432	LA-UR–89-3277

Contract No.	Abstract No.	Report No.
	15:4433	LA-UR--89-3289
	15:4434	LA-UR--89-3292
	15:4435	LA-UR--89-3297
	15:4436	LA-UR--89-3342
	15:4437	LA-UR--89-3407
	15:4487	LA--11634-MS
	Lawrence Livermore National Lab., CA (USA)	
	15:3593	LA--11651-MS
	15:3905	CONF-871147--
	15:3931	Published article
W-7405-ENG-48	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	15:3277	SLAC-PUB-5060
	Los Alamos National Lab., NM (USA)	
	15:3676	LA-UR--89-2000
	Lawrence Livermore National Lab., CA (USA)	
	15:2237	UCRL--98308
	15:2238	UCRL--98729
	15:2239	UCRL--100603
	15:2240	UCRL--101285
	15:2309	UCRL--21227-89
	15:2802	UCRL--98434
	15:2855	UCRL--98780
	15:2856	UCRL--100797
	15:2934	UCRL-Trans--12253
	15:2986	UCRL--98583
	15:2987	UCRL--98656
	15:2988	UCRL--102028
	15:3140	UCRL--100641
	15:3167	UCRL--100891
	15:3168	UCRL--102044
	15:3207	UCRL--100847
	15:3221	UCRL--100810
	15:3267	UCRL--101915
	15:3279	UCRL--21249
	15:3364	CONF-8602126--
	15:3372	UCRL--53935
	15:3382	UCRL--101879
	15:3390	UCRL--100794
	15:3468	UCID--21682
	15:3469	UCRL--101996
	15:3489	UCRL--21212
	15:3516	UCRL--100936
	15:3680	UCRL--100702
	15:3752	UCID--21824
	15:3791	UCID--21822
	15:3792	UCID--21823
	15:3896	UCRL--21256
	15:3898	UCRL--101247-Pts.1-2
	15:4122	UCRL--100763
	15:4236	UCRL--100752
	15:4237	UCRL--101088
	15:4258	UCRL--100596-Rev.1
	15:4352	UCID--21744
	15:4353	UCRL--21248
	15:4354	UCRL--21250
	15:4355	UCRL--52000-89-10
	15:4356	UCRL--97265
	15:4357	UCRL--97266
	15:4358	UCRL--101105
	15:4442	UCID--21810
	15:4445	UCRL--100432
	15:4446	UCRL--100533
	15:4447	UCRL--101113
	15:4448	UCRL--101145
	15:4449	UCRL--101148
	15:4450	UCRL--101481
	15:4451	UCRL--101649
	15:4452	UCRL--101756
	15:4488	UCID--21674
	15:4530	UCID--21796
	15:4531	UCRL--99673-Rev.1
	15:2581	UCRL--21229
	15:2650	UCID--21775-Vol.1
	15:2651	UCID--21775-Vol.2
	15:3166	UCRL--21254
	15:3897	UCRL--21257
	15:4481	CONF-870457--
	15:3178	CONF-871147--
	15:2867	CONF-8809145--
	15:2869	CONF-8809145--
	15:3020	Published article
	15:3907	Published article
	15:3911	Published article
	15:3914	Published article
	15:3915	Published article
	15:3916	Published article
	15:3925	Published article
	15:4181	Published article
	15:4295	Published article
	15:4384	Published article
	15:3067	CONF-871147--
	15:2877	Published article
	15:2889	Published article
	15:2962	Published article
	15:3021	Published article
	15:3083	Published article

Report Number Index

The report number index consists of the alphanumeric identifiers assigned to report literature as well as patent and conference literature cited in this publication. Entries provide the abstract number; the source(s) of availability of the document; the GPO file prefix for GPO depository library documents; the order number for OSTI and NTIS report ordering purposes; and, if the document was distributed under the DOE distribution program, the category number is shown for paper copy (PC), microfiche (MF), or no distribution (ND). These categories are included to assist DOE librarians in responding to requests for reports in their collections. The index also lists secondary numbers, with the corresponding abstract numbers and cross-references to other identifying numbers.

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
ACERR–					
1989	15:2603	Alberta Energy and National Resources, Information Centre, 9920-108 Street, Edmonton, Alberta, Canada K1A 0G1			
AD-A–					
207407/8/XAB	15:3383	NTIS, PC A06/MF A01			
207482/1/XAB	15:3947	NTIS, PC A09/MF A01			
207609/9/XAB	15:4497	NTIS, PC A08/MF A01			
210188/9/XAB	15:2119	NTIS, PC A03/MF A01			
210195/4/XAB	15:2120	NTIS, PC A03/MF A01			
210197/0/XAB	15:2897	NTIS, PC A03/MF A01			
210200/2/XAB	15:3795	NTIS, PC A14/MF A01			
210225/9/XAB	15:3595	NTIS, PC A02/MF A01			
210231/7/XAB	15:3610	NTIS, PC A03/MF A01			
210232/5/XAB	15:2660	NTIS, PC A04/MF A01			
210264/8/XAB	15:3222	NTIS, PC A03/MF A01			
210267/1/XAB	15:3796	NTIS, PC A02/MF A01			
210282/0/XAB	15:3328	NTIS, PC A03/MF A01			
210284/6/XAB	15:3797	NTIS, PC A03/MF A01			
210307/5/XAB	15:2806	NTIS, PC A03/MF A01			
210330/7/XAB	15:4498	NTIS, PC A25/MF A01			
210331/5/XAB	15:4499	NTIS, PC A15/MF A01			
210332/3/XAB	15:3611	NTIS, PC A02/MF A01			
210337/2/XAB	15:3881	NTIS, PC A03/MF A01			
210344/8/XAB	15:3755	NTIS, PC A07/MF A01			
210345/5/XAB	15:3117	NTIS, PC A09/MF A01			
210366/1/XAB	15:2560	NTIS, PC A07/MF A01			
210381/0/XAB	15:2781	NTIS, PC A09/MF A01			
210393/5/XAB	15:2782	NTIS, PC A03/MF A01			
210399/2/XAB	15:3596	NTIS, PC A03/MF A01			
210412/3/XAB	15:2604	NTIS, PC A06/MF A01			
210441/2/XAB	15:3820	NTIS, PC A03/MF A01			
210462/8/XAB	15:4550	NTIS, PC A06/MF A01			
210465/1/XAB	15:3935	NTIS, PC A04/MF A01			
210466/9/XAB	15:2716	NTIS, PC A05/MF A01			
210467/7/XAB	15:2717	NTIS, PC A07/MF A01			
210468/5/XAB	15:2718	NTIS, PC A05/MF A01			
210469/3/XAB	15:2719	NTIS, PC A05/MF A01			
210470/1/XAB	15:2720	NTIS, PC A05/MF A01			
210471/9/XAB	15:2721	NTIS, PC A04/MF A01			
210472/7/XAB	15:2722	NTIS, PC A04/MF A01			
210473/5/XAB	15:2723	NTIS, PC A05/MF A01			
210485/9/XAB	15:3577	NTIS, PC A03/MF A01			
210499/0/XAB	15:3379	NTIS, PC A05/MF A01			
210502/1/XAB	15:3360	NTIS, PC A03/MF A01			
210518/7/XAB	15:3474	NTIS, PC A05/MF A01			
210522/9/XAB	15:3882	NTIS, PC A03/MF A01			
210528/6/XAB	15:4500	NTIS, PC A03/MF A01			
210547/6/XAB	15:2121	NTIS, PC A06/MF A01			
210549/2/XAB	15:3223	NTIS, PC A06/MF A01			
210586/4/XAB	15:3936	NTIS, PC A03/MF A01			
210599/7/XAB	15:3798	NTIS, PC A05/MF A01			
210613/6/XAB	15:3142	NTIS, PC A03/MF A01			
210630/0/XAB	15:2653	NTIS, PC A03/MF A01			
210641/7/XAB	15:3542	NTIS, PC A07/MF A01			

AD-A–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
210657/3/XAB	15:3384	NTIS, PC A05/MF A01			
210658/1/XAB	15:2807	NTIS, PC A03/MF A01			
210663/1/XAB	15:3385	NTIS, PC A03/MF A01			
210698/7/XAB	15:3799	NTIS, PC A03/MF A01			
210706/8/XAB	15:3143	NTIS, PC A02/MF A01			
210708/4/XAB	15:3144	NTIS, PC A03/MF A01			
210722/5/XAB	15:4501	NTIS, PC A05/MF A01			
210726/6/XAB	15:3118	NTIS, PC A03/MF A01			
210737/3/XAB	15:3386	NTIS, PC A07/MF A01			
210741/5/XAB	15:4200	NTIS, PC A02/MF A01			
210743/1/XAB	15:4502	NTIS, PC A03/MF A01			
210755/5/XAB	15:2567	NTIS, PC A02/MF A01			
210758/9/XAB	15:3145	NTIS, PC A03/MF A01			
210760/5/XAB	15:4503	NTIS, PC A03/MF A01			
210769/6/XAB	15:3146	NTIS, PC A03/MF A01			
210773/8/XAB	15:3614	NTIS, PC A03/MF A01			
210778/7/XAB	15:3147	NTIS, PC A03/MF A01			
210780/3/XAB	15:3148	NTIS, PC A03/MF A01			
210781/1/XAB	15:2898	NTIS, PC A02/MF A01			
210786/0/XAB	15:2568	NTIS, PC A02/MF A01			
210789/4/XAB	15:2569	NTIS, PC A02/MF A01			
210791/0/XAB	15:3883	NTIS, PC A03/MF A01			
210792/8/XAB	15:3884	NTIS, PC A03/MF A01			
210825/6/XAB	15:2966	NTIS, PC A03/MF A01			
210826/4/XAB	15:2661	NTIS, PC A10/MF A01			
210841/3/XAB	15:3106	NTIS, PC A03/MF A01			
210844/7/XAB	15:3149	NTIS, PC A03/MF A01			
210858/7/XAB	15:3887	NTIS, PC A03/MF A01			
210860/3/XAB	15:3119	NTIS, PC A03/MF A01			
210861/1/XAB	15:3150	NTIS, PC A02/MF A01			
210879/3/XAB	15:3151	NTIS, PC A02/MF A01			
210903/1/XAB	15:3387	NTIS, PC A04/MF A01			
210909/8/XAB	15:2134	NTIS, PC A03/MF A01			
210947/8/XAB	15:3152	NTIS, PC A02/MF A01			
210978/3/XAB	15:2570	NTIS, PC A02/MF A01			
210979/1/XAB	15:2571	NTIS, PC A03/MF A01			
210988/2/XAB	15:3120	NTIS, PC A02/MF A01			
210999/9/XAB	15:4178	NTIS, PC A03/MF A01			
211029/4/XAB	15:3401	NTIS, PC A03/MF A01			
211039/3/XAB	15:3153	NTIS, PC A02/MF A01			
211055/9/XAB	15:2122	NTIS, PC A03/MF A01			
211070/8/XAB	15:2899	NTIS, PC A06/MF A01			
211099/7/XAB	15:2808	NTIS, PC A02/MF A01			
211107/8/XAB	15:3185	NTIS, PC A07/MF A01			
211117/7/XAB	15:3154	NTIS, PC A12/MF A01			
211119/3/XAB	15:4201	NTIS, PC A02/MF A01			
211124/3/XAB	15:4202	NTIS, PC A03/MF A01			
211153/2/XAB	15:3543	NTIS, PC A04/MF A01			
211154/0/XAB	15:2809	NTIS, PC A09/MF A01			
211160/7/XAB	15:3689	NTIS, PC A03/MF A01			
211166/4/XAB	15:2810	NTIS, PC A03/MF A01			
211170/6/XAB	15:2967	NTIS, PC A03/MF A01			
211185/4/XAB	15:3690	NTIS, PC A03/MF A01			
211190/4/XAB	15:3691	NTIS, PC A03/MF A01			
211198/7/XAB	15:3544	NTIS, PC A05/MF A01			
211201/9/XAB	15:3402	NTIS, PC A03/MF A01			
211220/9/XAB	15:3692	NTIS, PC A02/MF A01			
211221/7/XAB	15:3756	NTIS, PC A03/MF A01			
211225/8/XAB	15:3212	NTIS, PC A03/MF A01			
211242/3/XAB	15:3403	NTIS, PC A05/MF A01			
211246/4/XAB	15:3121	NTIS, PC A08/MF A01			
211248/0/XAB	15:3329	NTIS, PC A03/MF A01			
211249/8/XAB	15:2900	NTIS, PC A02/MF A01			
211254/8/XAB	15:2572	NTIS, PC A03/MF A01			
211270/4/XAB	15:3757	NTIS, PC A07/MF A01			
211272/0/XAB	15:3597	NTIS, PC A03/MF A01			
211281/1/XAB	15:2901	NTIS, PC A03/MF A01			
955597/0/XAB	15:3885	NTIS, PC A02/MF A01			
AEEW-M–					
2496	15:3122	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90608623	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
2520	15:3123	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608625	
2536	15:2175	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608837	
AEEW-R–					
1903	15:2176	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608332	
2033	15:3124	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608626	
2094	15:2177	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608838	
2201	15:3186	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608605	
2227	15:3039	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90607900	
2305	15:3068	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607901	
2341	15:3069	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607902	
AERE-R–					
12939	15:2178	H.M. Stationery Office, London, price Pound 10.00			
12955	15:2179	H.M. Stationery Office, London, price Pound 14.00			
AEROCHEM-TP–					
484	15:3114	*See* PB–89-231617/XAB			
AFAL-SR–					
89-001	15:3947	*See* AD-A–207482/1/XAB			
AFGL-TR–					
88-0217	15:3474	*See* AD-A–210518/7/XAB			
AFIT/GEP/GNE–					
89M-2	15:3383	*See* AD-A–207407/8/XAB			
AFOEHL–					
89-040EQ0109ESC	15:3577	*See* AD-A–210485/9/XAB			
89-051EQ0058FEF	15:3403	*See* AD-A–211242/3/XAB			
AFRRI-SR–					
89-15	15:3691	*See* AD-A–211190/4/XAB			
89-16	15:3689	*See* AD-A–211160/7/XAB			
89-17	15:3756	*See* AD-A–211221/7/XAB			
89-19	15:3690	*See* AD-A–211185/4/XAB			
89-20	15:3692	*See* AD-A–211220/9/XAB			
AFWL-TR–					
89-35	15:3936	*See* AD-A–210586/4/XAB			
AGARD-AG–					
315	15:3185	*See* AD-A–211107/8/XAB			
AIAA–					
89-2334	15:2780	*See* N–89-27700			
ANL–					
88-37	15:2432	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001804	MF-201
89/2-Rev.1	15:4504	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002925	
89/28	15:2794	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001807	PC-333
ANL-HEP-CP–					
89-109	15:3973	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002205	MF-414
89-112	15:3974	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002843	MF-414
89-122	15:3260	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003384	MF-414
89-69	15:3972	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002226	MF-414
ANL/CNSV–					
69	15:2269	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002619	MF-242; MF-243
ANL/EES-TM–					
378	15:4505	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001782	
ANL/PPRNT–					
89-183	15:3404	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003002	MF-402
89-184	15:4248	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003001	MF-410
89-185	15:4249	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002999	MF-411; MF-404
89-186	15:4250	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002998	MF-411; MF-404
89-188	15:2758	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002996	MF-110
89-189	15:2902	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003006	MF-404
89-190	15:4203	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003005	MF-411

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-191	15:3608	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003004	MF-408
89-192	15:3975	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003003	MF-414
89-193	15:2092	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003009	MF-104
89-194	15:3598	NTIS, PC A03/MF A01 - OSTI		DE90003008	MF-408
89-195	15:4506	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003007	MF-405
89-196	15:4081	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003013	MF-414
89-197	15:4251	NTIS, PC A03/MF A01; OSTI; INIS		DE90003012	MF-414
89-198	15:3599	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003011	MF-408
89-199	15:4252	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003010	MF-411
ANL/TM–					
474	15:4535	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002596	MF-405
ARB/SSD–					
89-01	15:3430	*See* PB–89-217814/XAB			
AUC-IBT-R–					
8722	15:3255	Available on loan from Risoe Library, DK-4000 Roskilde.			
BARC–					
1447	15:2163	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90607954	
1449	15:2811	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90607963	
1453	15:4183	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608340	
1464	15:4062	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90607770	
BAW–					
2016	15:2550	*See* NUREG/CR–5395-Vol.8			
2062	15:2547	*See* NUREG/CR–5395-Vol.4			
2065	15:2548	*See* NUREG/CR–5395-Vol.6			
2066	15:2549	*See* NUREG/CR–5395-Vol.7			
BFLRF–					
251	15:2122	*See* AD-A–211055/9/XAB			
BFR-R–					
49-1989	15:3800	NTIS (US Sales Only), PC A03/MF A01		DE90719422	
BMU–					
1988-196	15:3502	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
1989-207	15:3567	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
1989-226	15:2495	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
BNL–					
42550-Rev.	15:2903	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003261	MF-404
42573	15:3070	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001532	MF-401
42814	15:4070	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003254	MF-413
43086	15:3615	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001331	MF-408
43108	15:2812	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002303	MF-420
43112	15:3600	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002301	MF-404
43127-Rev.	15:3405	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002292	MF-402
43128	15:2107	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003262	MF-400
43214	15:3071	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002458	MF-404
43281	15:3261	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002293	MF-414
43298	15:2496	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001533	
43344	15:3283	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002302	MF-406
43345	15:4204	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002299	MF-410
43347	15:3314	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002296	
43348	15:3284	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002289	MF-414
43350	15:3315	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002297	MF-404
43361	15:3406	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002590	MF-402
43367	15:2457	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002310	MF-504
43372	15:4253	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002298	MF-406
43373	15:2904	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003255	MF-404; MF-410
43376	15:4125	*See* DOE/ER/40417–4			
43385	15:4123	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002295	MF-413
43394	15:3258	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003260	MF-414
43464	15:3102	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003253	MF-601

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
BNL-NUREG–					
51581-Vol.8	15:2540	*See* NUREG/CR–2907-Vol.8			
52197	15:2546	*See* NUREG/CR–5364			
BNWL-CC–					
2048	15:2166	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001662	MF-711
BR–					
82(11.111)	15:3536	OSTI - US Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Blvd., Slidell, LA 70458		TI90002535	
82(11.113)	15:3537	OSTI; US Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gause Boulevard, Slidell, LA 70458		TI90002968	
85(7.27)	15:3538	NTIS, PC A08/MF A01 - OSTI		TI90002814	
BRA–					
89-342R	15:3166	*See* UCRL–21254			
BRE-IP–					
10/89	15:2662	NTIS (US Sales Only), PC A02/MF A01		DE90722671	
11/89	15:2663	NTIS (US Sales Only), PC A02/MF A01		DE90722672	
BRL-MR–					
3771	15:3385	*See* AD-A–210663/1/XAB			
BRL-TR–					
2999	15:2660	*See* AD-A–210232/5/XAB			
3025	15:4178	*See* AD-A–210999/9/XAB			
CEA-CONF–					
9289	15:3040	NTIS (US Sales Only), PC A02/MF A01		DE89781528	
9796	15:3976	NTIS (US Sales Only), PC A03/MF A01		DE90721236	
9799	15:4300	NTIS (US Sales Only), PC A03/MF A01		DE90721235	
9800	15:4386	NTIS (US Sales Only), PC A04/MF A01		DE90721239	
9877	15:2813	NTIS (US Sales Only), PC A02/MF A01		DE90721179	
CEA-DAS–					
539	15:2497	NTIS (US Sales Only), PC A03/MF A01		DE90721233	
603	15:2498	NTIS (US Sales Only), PC A03/MF A01		DE90721101	
CEA-N–					
-2606	15:4507	NTIS (US Sales Only), PC A04/MF A01		DE90721138	
2605	15:2470	NTIS (US Sales Only), PC A17/MF A01		DE90721137	
2607	15:3363	NTIS (US Sales Only), PC A03/MF A01		DE90721139	
CEA-R–					
5475	15:2814	NTIS (US Sales Only), PC A14/MF A01		DE90721226	
5492	15:4184	NTIS (US Sales Only), PC A08/MF A01		DE90721224	
CEBAF-PR–					
88-015	15:3948	*See* DOE/ER/40150–89			
CEC–					
90003094	15:2124	OSTI; California Energy Commission, Publications Unit, 1516 Ninth Street, MS-13, Sacramento, CA 95814		TI90003094	
CEGB-RD/B–					
6040/R88	15:2815	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607993	
CEGB-RD/L–					
3354/R88	15:2816	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607968	
CEGB-TPRD/M–					
1697/RR88	15:2817	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607959	
CENBG–					
88-25	15:4071	NTIS (US Sales Only), PC A02/MF A01		DE90721240	
89-04	15:4063	NTIS (US Sales Only), PC A03/MF A01		DE90721241	
CERL-TM-E–					
89/11	15:2661	*See* AD-A–210826/4/XAB			
CERL-TR-E–					
89/09	15:2604	*See* AD-A–210412/3/XAB			
CNEN-DR–					
112/82	15:2499	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608312	
88/80/A	15:2441	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE90608697	
CNEN-NE–					
1.13	15:2248	Centro de Informacoes Nucleares of the Comissao Nacional de Energia Nuclear, RJ, Brazil			
1.22	15:3475	Centro de Informacoes Nucleares of the Comissao Nacional de Energia Nuclear, RJ, Brazil			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CNSS/Papers–					
21	15:3593	*See* LA–11651-MS			
CONF-8602126–		(Mass spectrometry conference; Irvine, CA (USA); 15 Feb 1986)			
	15:3364	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002222	MF-700
CONF-8606431–		(Solar Energy Conservation Training Institute workshop on desiccant cooling and dehumidification opportunities for buildings; Chattanooga, TN (USA); 10-11 Jun 1986)			
	15:2700	*See* SERI/CP–254-3000			
CONF-8610118–		(Korea/US joint heat transfer seminar on thermal engineering and high technology systems; Seoul (Republic of Korea); 16-22 Oct 1986)			
	15:2805	Hemisphere Publishing, 79 Madison Avenue, New York, NY 10016			
CONF-8612177–		(14. NIRS seminar on environmental research; Chiba (Japan); 5 Dec 1986)			
	15:3570	*See* NIRS-M–70			
CONF-8701163–		(10. annual symposium in plant physiology: plant senescence: its biochemistry and physiology; Riverside, CA (USA); 6-10 Jan 1987)			
	15:3601	American Society of Plant Physiologists, 15501-A Monona Drive, Rockville, MD 20855			ND-408
CONF-8703326–		(Conference on interplanetary particle environment; Pasadena, CA (USA); 16-17 Mar 1987)			
	15:3361	*See* N–89-28454			
CONF-870457–		(Annual meeting of Fusion Power Associates: applications of laser, particle beam, and RF power technologies; Pleasanton, CA (USA); 8-9 Apr 1987)			
	15:3312				
	15:3313				
	15:4480				
	15:4481				
	15:4482				
CONF-8705394–		(4. seminar of chemical control in metallurgy; Belo Horizonte (Brazil); 25-27 May 1987)			
	15:4224	*See* INIS-BR–1762			
CONF-8705395–		(5. Seminar on Industrial Safety; Fortaleza (Brazil); 26-29 May 1987)			
	15:2123	*See* INIS-BR–1718			
	15:2172	*See* INIS-BR–1721			
	15:4187	*See* INIS-BR–1719			
	15:4188	*See* INIS-BR–1720			
CONF-870566–		(Institute of Environmental Sciences annual meeting; San Jose, CA (USA); 4-8 May 1987)			
3	15:3389	*See* SAND–86-2189C			
CONF-8707107–		(1. international conference on laser M2P; Lyon-Villeurbanne, France; 7-9 Jul 1987)			
	15:3040	*See* CEA-CONF–9289			
CONF-8707219–		(Materials Properties Council workshop on scatter of fracture toughness data in the transition temperature regime; Boulder, CO (USA); 16 Jul 1987)			
1	15:2820	NTIS, PC A03/MF A01; OSTI; INIS		DE90001596	
CONF-8708236–		(6. conference on optical materials technology for energy efficiency and solar energy conversion; San Diego, CA (USA); 18-19 Aug 1987)			
	15:2344				
CONF-8708335–		(International workshop on time-variable phenomena in the Jovian System; Flagstaff, AZ (USA); 25 Aug 1987)			
	15:3867	*See* N–89-28474			
CONF-8709122–		(Specialists' meeting on data for decay heat predictions; Studsvik (Sweden); 7-10 Sep 1987)			
	15:4121	*See* NEACRP–302-L(Rev.)			
CONF-870947–		(12. conference on the numerical simulation of plasmas; San Francisco, CA (USA); 20-23 Sep 1987)			
12	15:4356	*See* UCRL–97265			
13	15:4357	*See* UCRL–97266			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8709477–		(International symposium on integrity of offshore structures; Glasgow (UK); Sep 1987)			
	15:3255	*See* AUC-IBT-R–8722			
CONF-870959–		(1. international conference on neutron physics; Kiev (USSR); 14-18 Sep 1987)			
	15:4179	*See* INDC(NDS)–224/GF			
	15:4416	*See* INDC(CCP)–301/GF			
CONF-8710466–		(Workshop on turbine engine hot section technology; Cleveland, OH (USA); 20-21 Oct 1987)			
	15:3236	*See* N–89-17298			
CONF-8711126–		(Symposium on fundamentals of beam-solid interactions and transient thermal processing; Boston, MA (USA); 30 Nov - 3 dec 1987)			
	15:2857				
CONF-871147–		(3. international laser science conference: advances in laser science; Atlantic City, NJ (USA); 1-5 Nov 1987)			
	15:3002				
	15:3067				
	15:3173				
	15:3174				
	15:3175				
	15:3176				
	15:3177				
	15:3178				
	15:3886				
	15:3900				
	15:3901				
	15:3902				
	15:3903				
	15:3904				
	15:3905				
	15:4238				
CONF-871234–		(ASME winter meeting; Boston, MA (USA); 13-18 Dec 1987)			
16	15:2518	*See* EGG-M–36787			
CONF-871288–		(9. Brazilian congress of mechanical engineering; Florianopolis (Brazil); 7-11 Dec 1987)			
	15:2836	*See* INIS-BR–1689			
CONF-880122–		(5. symposium on space nuclear power systems; Albuquerque, NM (USA); 11-14 Jan 1988)			
24	15:2831	*See* EGG-M–37087			
CONF-880139–		(26. AIAA aerospace conference; Reno, NV (USA); 10-14 Jan 1988)			
5	15:4404	*See* EGG-M–36587			
CONF-8802102–		(Workshop on clinical aspects of Boron Neutron Capture Theory (BNCT); Upton, NY (USA); 1-2 Feb 1988)			
6	15:3615	*See* BNL–43086			
CONF-880302–		(2. International conference on circulating fluidized bed boilers; Compiegne (France); 14-18 Mar 1988)			
1	15:3466	*See* STEV-FBT–89-25			
CONF-880309–		(International symposium on severe accidents in nuclear power plants IAEA - OECD/NEA; Sorrento (Italy); 21-25 Mar 1988)			
8	15:2517	*See* EGG-M–32787			
CONF-8803160–		(1. European conference on industrial furnaces and boilers; Lisbon (Portugal); 21-24 Mar 1988)			
1	15:2074	*See* STEV-FBT–89-26			
CONF-8803244–		(Strategic defense initiative: first five years conference; Washington, DC (USA); 13-15 Mar 1988)			
1	15:2802	*See* UCRL–98434			
CONF-8803245–		(International conference on extending database technology; Venice (Italy); 14-18 Mar 1988)			
1	15:4541	*See* LBL–24121			
CONF-880379–		(DOE maintenance management conference; New Orleans, LA (USA); 28 Mar - 1 apr 1988)			
2	15:2419	*See* POEF-M–19			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-880417–		(1. international symposium on nuclear fusion technology (ISFNT); Tokyo (Japan); 10-19 Apr 1988)			
Pt.2	15:4443	*See* UCLA/PPG–1135			
CONF-8804309–		(Organization for Economic Cooperation and Development/Nuclear Energy Agency Excavation Response workshop; Winnipeg (Canada); 29 Apr 1988)			
1	15:2237	*See* UCRL–98308			
CONF-880469–		(2. international symposium on transport phenomena, dynamics, and design of rotating machinery; Honolulu, HI (USA); 3-6 Apr 1988)			
2	15:3937	*See* EGG-M–38887			
CONF-8805174–		(IAEA consultants' meeting on the physics of neutron emission in fission; Mito (Japan); 24-27 May 1988)			
	15:4134	*See* INDC(NDS)–220			
CONF-8805213–		(IAEA specialists' meeting on carbon and oxygen collision data for fusion plasma research; Vienna (Austria); 12-13 May 1988)			
	15:3899				
CONF-8805338–		(Minsk international heat and mass transfer forum; Minsk (USSR); May 1988)			
	15:2101	*See* STEV-FBT–89-27			
CONF-8805340–		(1. international conference on transportation for the nuclear industry; Stratford-upon-Avon (UK); 23-25 May 1988)			
	15:3123	*See* AEEW-M–2520			
CONF-880606–		(10. symposium on thermophysical properties; Gaithersburg, MD (USA); 20-23 Jun 1988)			
	15:3210				
CONF-8806143–		(Nuclear reactor severe accident chemistry symposium; Toronto (Canada); 5-10 Jun 1988)			
10	15:2485	*See* EGG-M–34487			
CONF-8806260–		(19. international symposium on multiparticle dynamics - new data and theoretical trends; Arles (France); 13-17 Jun 1988)			
4	15:3979	*See* DOE/ER/40224–90			
CONF-8806370–		(International workshop on wear modeling: the modeling of wear in energy conversion and utilization technologies; Argonne, IL (USA); 16-17 Jun 1988)			
	15:3214	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001889	MF-373
CONF-8806435–		(Summer program on studying turbulence using numerical simulation databases; Stanford, CA (USA); 27 Jun - 22 jul 1988)			
	15:3203	*See* N–89-24538			
CONF-8806441–		(4. IAERU seminar; Tokyo (Japan); 18 Jun 1988)			
	15:4486	*See* IAERU–8802			
CONF-8807195–		(Workshop for cascade project; Ibaraki (Japan); 13 Jul 1988)			
	15:4069	*See* RCNP-P–102			
CONF-880724–		(25. American Society of Mechanical Engineers/American Institute of Chemical Engineers/American Nuclear Society national heat transfer conference; Houston, TX (USA); 24-27 Jul 1988)			
29	15:2727	*See* EGG-M–36387			
CONF-880748–		(American Nuclear Society topical meeting on nuclear power plant life extension; Snowbird, UT (USA); 31 Jul - 3 aug 1988)			
13	15:2521	*See* EGG-M–88275			
CONF-880794–		(U.S.-Japan/IEA workshop on next-generation experiments and reactors; Kyoto (Japan); 25-28 Jul 1988)			
	15:4440	*See* PPLK–10			
CONF-880810–		(10. IUPAC conference on chemical thermodynamics; 4. Polish conference on calorimetry and thermal analysis; Prague (Czechoslovakia); Warsaw (Poland); 29 Aug - 2 sep 1988; 4-10 sep 19)			
2	15:2968	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002260	MF-404; MF-401

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8808141–		(3. international conference on synchrotron radiation instrumentation; Tsukuba (Japan); 29 Aug - 2 sep 1988)			
15	15:3283	*See* BNL–43344			
CONF-8808145–		(4. meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT (USA); 15-18 Aug 1988)			
	15:3942	World Scientific Publishing Co., Inc., 687 Hartwell St., Teaneck, NJ 07666 (USA)		DE90003097	ND-414
CONF-880824–		(International nuclear power plant aging symposium; Bethesda, MD (USA); 30 Aug - 1 sep 1988)			
5	15:2522	*See* EGG-M–88300			
CONF-8808273–		(ACEEE summer study on energy efficiency in buildings; Asilomar, CA (USA); 29 Aug - 1 sep 1988)			
Vol.7	15:2620	ACEEE, 1001 Connecticut Ave., NW, Washington, DC 20036			ND-350
CONF-8808275–		(Japan-U.S. workshop P-118 on vacuum technologies for fusion devices; Nagoya (Japan); 1-5 Aug 1988)			
	15:4419	*See* IPPJ-T–38			
CONF-880870–		(4. international conference on infrared physics; Zurich (Switzerland); 22-26 Aug 1988)			
4	15:2987	*See* UCRL–98656			
CONF-880887–		(32. international technical symposium on optical and opto-electronic applied science and engineering; San Diego, CA (USA); 14-19 Aug 1988)			
	15:2929	*See* N–89-27836			
CONF-880903–		(Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA (USA); 11-15 Sep 1988)			
53-Rev.	15:2205	*See* LBL–24805-Rev.			
CONF-880911–		(International reactor physics conference; Jackson Hole, WY (USA); 18-21 Sep 1988)			
35	15:2490	*See* EGG-M–88270			
CONF-880912–		(196. American Chemical Society national meeting; Los Angeles, CA (USA); 25-30 Sep 1988)			
31	15:2062	*See* EGG-M–88261			
32	15:2238	*See* UCRL–98729			
34	15:2986	*See* UCRL–98583			
CONF-8809145–		(Thermodynamics of nuclear materials; Chicago, IL (USA); 27 Sep 1988)			
	15:2867				
	15:2868				
	15:2869				
CONF-8809198–		(10. IUPAC conference on chemical thermodynamics; 4. Polish conference on calorimetry and thermal analysis; Prague (Czechoslovakia); Warsaw (Poland); 29 Aug - 2 sep 1988; 4-10 sep 19)			
1	15:2968	*See* CONF-880810–2			
CONF-8809203–		(Quark Matter '88: 7th international conference on ultrarelativistic nucleus-nucleus collisions; Lenox, MA (USA); 26-30 Sep 1988)			
	15:3976	*See* CEA-CONF–9796			
CONF-8809380–		(4. conference of roentgenologists and radiologists of Byelorussian SSR; Grodno (USSR); 8 Sep 1988)			
	15:3625	*See* INIS-SU–114			
CONF-8809414–		(International symposium on free-radical and radiation-induced damage to DNA; Muelheim an der Ruhr (Germany, F.R.); 25-30 Sep 1988)			
	15:3699	*See* INIS-mf–12012			
CONF-8809415–		(International School of Plasma Physics; Varenna (Italy); 6-16 Sep 1988)			
	15:4300	*See* CEA-CONF–9799			
	15:4386	*See* CEA-CONF–9800			
CONF-880955–		(International conference on the physics of multiply charged ions and international workshop on E.C.R. ion sources; Grenoble (France); 12-16 Sep 1988)			
	15:4071	*See* CENBG–88-25			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-881011–		(Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC (USA); 30 Oct - 4 nov 1988)			
	15:2431				
	15:2463				
	15:2558				
	15:2559				
	15:3209				
41	15:2523	*See* EGG-M–88428			
42	15:2524	*See* EGG-M–88438			
CONF-881013–		(JIGASTOCK '88: international conference on applied geothermal energy and thermal energy storage; Versailles (France); 18-21 Oct 1988)			
5	15:2357	*See* EGG-M–88264			
CONF-881014–		(International European Nuclear Society/American Nuclear Society meeting on thermal reactor safety; Avignon (France); 2-7 Oct 1988)			
	15:2497	*See* CEA-DAS–539			
CONF-881024–		(TMI-2 accident materials behavior, plant technology and recovery; Washington, DC (USA); 30 Oct - 4 nov 1988)			
16	15:2486	*See* EGG-M–88154			
17	15:2519	*See* EGG-M–88156			
18	15:2520	*See* EGG-M–88163			
CONF-8810264–		(Conference on hadronic matter in collision; Tucson, AZ (USA); 6-12 Oct 1988)			
14	15:3980	*See* DOE/ER/40224–91			
CONF-881031–		(8. topical meeting on technology of fusion energy; Salt Lake City, UT (USA); 9-13 Oct 1988)			
74	15:4406	*See* EGG-M–88268			
76	15:4444	*See* UCRL–98191			
77	15:4405	*See* EGG-M–88260			
CONF-8810441–		(Workshop on artificial clay barriers for high level radioactive waste repositories; Lund (Sweden); 5-7 Oct 1988)			
	15:2223	*See* PNCT-N–8410-89-008			
CONF-8810443–		(EUROCORR'88: Symposium on Corrosion; Brighton (UK); 3-5 Oct 1988)			
	15:2813	*See* CEA-CONF–9877			
CONF-881049–		(14. linear accelerator conference (LINAC-14); Williamsburg, VA (USA); 3-7 Oct 1988)			
81	15:3948	*See* DOE/ER/40150–89			
CONF-881058–		(Human Factors Society annual meeting; Anaheim, CA (USA); 24-28 Oct 1988)			
5	15:3127	*See* EGG-M–88271			
6	15:4514	*See* EGG-M–88277			
7	15:2480	*See* EGG-M–88288			
CONF-881066–		(12. international symposium on the scientific basis for nuclear waste management; Berlin (Germany, F.R.); 10-13 Oct 1988)			
	15:2224	*See* PNCT-N–8410-89-009			
	15:3804	*See* PNCT-N–8410-89-010			
CONF-8811277–		(35. Brazilian Congress of Geology; Belem (Brazil); 6-13 Nov 1988)			
	15:3044	*See* INIS-BR–1627			
CONF-8811281–		(Hydrogen conference; Palo Alto, CA (USA); 16-17 Nov 1988)			
	15:2258	*See* EPRI-GS–6563			
CONF-8811282–		(Society of Risk Analysis annual conference; Washington, DC (USA); 1 Nov 1988)			
1	15:2193	*See* EGG-M–88181			
CONF-8811284–		(2. symposium on aerodynamics of wind turbines; Lyngby (Denmark); 21-22 Nov 1988)			
	15:2365	*See* NEI-DK–221			
Suppl.	15:2379	*See* NEI-DK–222			
CONF-8811285–		(ASTM symposium on thermal and mechanical behavior of ceramic and metal matrix composites; Atlanta, GA (USA); 7-8 Nov 1988)			
	15:2976	*See* N–89-27795			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8811286–		(IFE colloquium on crude oil emulsions; Clausthal-Zellerfeld (Germany, F.R.); 25 Nov 1988)			
Absts.	15:2108	NTIS (US Sales Only), PC A03/MF A01		DE90721817	
CONF-881143–		(American Institute of Chemical Engineers annual meeting; Washington, DC (USA); 27 Nov - 2 dec 1988)			
	15:2048	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:2049	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:2075	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:2271	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:3394	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:3395	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
CONF-881162–		(9. electric vehicle symposium; Toronto (Canada); 13-16 Nov 1988)			
4	15:2577	*See* EGG-M–88115			
CONF-881205–		(Symposium on coal, oil, and gas biotechnology; New Orleans, LA (USA); 5-7 Dec 1988)			
3	15:2063	*See* EGG-M–88469			
CONF-881206–		(4. Israel materials engineering conference; Beer-Sheva (Israel); 7-8 Dec 1988)			
	15:2870				
CONF-8812107–		(Fall meeting of the American Geophysical Union; San Francisco, CA (USA); 4 Dec 1988 - 8 dec 1989)			
1	15:2105	*See* LBL–27846			
CONF-8812115–		(3. Australia/Japan workshop on neutron capture therapy for malignant melanoma; Sydney (Australia); 13-14 Dec 1988)			
1	15:3609	*See* EGG-M–88477			
CONF-8812116–		(Specialists' meeting on physics and engineering of fission and spallation; Kumatori (Japan); 19 Dec 1988)			
	15:4159	*See* KURRI-TR–315			
CONF-8812118–		(14. radiation hygiene days; Brno (Czechoslovakia); 8-9 Dec 1988)			
	15:4191	*See* INIS-mf–11562			
CONF-881266–		(US-Japan fusion cooperation program exchange P148 workshop on advanced current drive concepts; Kyoto (Japan); 6-8 Dec 1988)			
	15:4319	*See* IPPJ-REV–4			
CONF-890102–		(12. ASME annual energy-sources technology conference and exhibition; Houston, TX (USA); 22-25 Jan 1989)			
	15:2387	American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017			
CONF-8901115–		(Topical conference on electronuclear physics with internal targets; Stanford, CA (USA); 9-12 Jan 1989)			
6	15:4126	*See* DOE/ER/40427–09-N9			
CONF-8901120–		(27. international winter meeting on nuclear physics; Bormio (Italy); 23-27 Jan 1989)			
	15:4063	*See* CENBG–89-04			
CONF-8901165–		(Workshop on computing directions and options for data acquisition and analysis at LAMPF; Los Alamos, NM (USA); 11-13 Jan 1989)			
Summ.	15:3297	*See* LA–11662-MS			
CONF-8901166–		(ITER burn control meeting; Livermore, CA (USA); Jan 1989)			
1	15:4302	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001564	MF-427
CONF-8902143–		(Workshop on hadron spectroscopy; Vancouver (Canada); 21 Feb 1989)			
1	15:3960	*See* LBL–27599			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890238–		(Annual meeting and exhibit of the Society of Mining Engineers, Inc.; Las Vegas, NV (USA); 27 Feb - 2 mar 1989)			
5	15:2832	*See* EGG-M–88357			
CONF-890240–		(Society of Automotive Engineers international congress and exposition; Detroit, MI (USA); 27 Feb - 3 mar 1989)			
	15:2582	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
	15:2583	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
	15:2584	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
	15:2585	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
	15:2586	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
	15:2587	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
	15:2588	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
	15:2788	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
	15:2789	Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096			
CONF-890270–		(International industrial symposium on the super collider; New Orleans, LA (USA); 8-10 Feb 1989)			
24	15:3300	*See* LBL–26248			
CONF-8903112–		(Waste management '89; Tucson, AZ (USA); 1 Mar 1989)			
5	15:2239	*See* UCRL–100603			
CONF-8903138–		(ILL workshop on fundamental physics with slow neutrons; Grenoble (France); 8-11 Mar 1989)			
1	15:4070	*See* BNL–42814			
CONF-8903169–		(3. SIAM conference on domain decomposition methods; Society for Industrial and Applied Mathematics (SIAM) national meeting; Houston, TX (USA); San Diego, CA (USA); 20-22 Mar 1989; 16-21 jul 1989)			
2	15:4508	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002695	MF-405
CONF-8903173–		(Annual conference on filtration and separation; Pittsburgh, PA (USA); 27-29 Mar 1989)			
1	15:2420	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002249	MF-105
CONF-8903175–		(Recontre de Moriond conference; Les Arcs (France); 12-17 Mar 1989)			
1	15:3972	*See* ANL-HEP-CP–89-69			
CONF-890335–		(13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989)			
267	15:3284	*See* BNL–43348			
CONF-890379–		(Workshop on calorimetry for the SSC; Tuscaloosa, AL (USA); 13-17 Mar 1989)			
16	15:3331	*See* DOE/ER/40224–129			
CONF-890402–		(10. international conference on fluidized-bed combustion; San Francisco, CA (USA); 30 Apr - 3 may 1989)			
8	15:3250	*See* STEV-FBT–89-24			
CONF-890415–		(Computing in high energy physics; Oxford (UK); 10-14 Apr 1989)			
11	15:4516	*See* FNAL/C–89/172			
CONF-8904156–		(CSNI-CEC specialist meeting on trends and pattern analyses of operational data from nuclear power plants; Rome (Italy); 3-7 Apr 1989)			
	15:2498	*See* CEA-DAS–603			
CONF-890422–		(International conference on municipal waste combustion; Hollywood, FL, US; April 11, 1989)			
1	15:3758	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89008725	
CONF-8904226–		(12. international workshop on weak interactions and neutrinos; Ginosar (Israel); 9-14 Apr 1989)			
9	15:3965	*See* SLAC-PUB–4984			
10	15:3984	*See* DOE/ER/40389–54			
11	15:3974	*See* ANL-HEP-CP–89-112			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
12	15:3982	*See* DOE/ER/40224–110			
CONF-8904257–		(Quantum fluids and solids; Gainesville, FL (USA); Apr 1989)			
	15:3938	American Inst. of Physics, 335 E. 45th St., New York, NY 10017			
CONF-8904274–		(NRC regulatory information conference; Washington, DC (USA); 18-20 Apr 1989)			
Vol.1	15:2538	*See* NUREG/CP–0102-Vol.1			
CONF-8904280–		(International conference on electromagnetic transitions in atomic nuclei; Tashkent (USSR); 18-21 Apr 1989)			
2	15:4158	*See* JINR-E–6-89-411			
CONF-8904281–		(Particle accelerator conference; Chicago, IL (USA); 20-23 Apr 1989)			
1	15:3317	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002255	MF-414
CONF-8904282–		(22. annual American Vacuum Society Southern California symposium; Los Angeles, CA (USA); 3-7 Apr 1989)			
1	15:3315	*See* BNL–43350			
CONF-8904288–		(Computer and geophysical research conference; Houston, TX (USA); 24-26 Apr 1989)			
1	15:4509	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002263	MF-405
CONF-8904289–		(Solutions '89 international conference; Pine Mountain, GA (USA); 30 Apr - 3 may 1989)			
1	15:2421	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002272	MF-105
CONF-8904290–		(Symposium J: interfaces between polymers, metals and ceramics; San Diego, CA (USA); 24-29 Apr 1989)			
1	15:2821	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002268	MF-404
2	15:4206	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002270	MF-411
3	15:4207	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002266	MF-411
CONF-890437–		(Corrosion '89; New Orleans, LA (USA); 17-21 Apr 1989)			
13	15:2093	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002256	MF-114
CONF-890480–		(Conference on oxygen disorder effects in high T_c superconductors; Trieste (Italy); 18-21 Apr 1989)			
2	15:2905	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002217	MF-404
CONF-890492–		(Natural gas research and development; Morgantown, WV (USA); 18-19 Apr 1989)			
	15:2142	*See* DOE/METC–89/6103			
CONF-8905112–		(ASTM symposium on the applications of automation technology to fatigue and fracture testing; Kansas City, MO (USA); 22-23 May 1989)			
2	15:4397	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002721	MF-420
3	15:3215	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002931	
CONF-8905126–		(Workshop on cold fusion phenomena; Santa Fe, NM (USA); 23-25 May 1989)			
7	15:2575	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002198	MF-400
CONF-8905136–		(Joint NEA/CEC workshop on sealing of radioactive waste repositories; Braunschweig (Germany, F.R.); 22-25 May 1989)			
3	15:2236	*See* SAND–89-0386			
CONF-8905143–		(NATO advanced study institute international advanced course on the nuclear equation of state; Peniscola (Spain); 12 May - 3 jun 1989)			
19	15:4124	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002202	MF-413
20	15:3261	*See* BNL–43281			
CONF-8905144–		(Tau-Charm Factory workshop; Stanford, CA (USA); 23-27 May 1989)			
	15:3962	*See* SLAC–343			
CONF-8905152–		(Workshop on cement stabilization of low-level radioactive waste; Gaithersburg, MD (USA); 31 May - 2 jun 1989)			
	15:2214	*See* NUREG/CP–0103			
CONF-890517–		(10. symposium on microdosimetry; Rome (Italy); 21-26 May 1989)			
5	15:3748	*See* PNL-SA–16690			
CONF-8905187–		(WEIN '89: international symposium on weak and electromagnetic interactions in nuclei; Montreal (Canada); 15-19 May 1989)			
5	15:3332	*See* DOE/ER/40389–57			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
6	15:3985	*See* DOE/ER/40427–11-N9			
7	15:4019	*See* DOE/ER/40427–14-N9			
8	15:4018	*See* DOE/ER/40427–13-N9			
CONF-8905188–		(Conference on magnetic properties of low-dimensional systems II; San Luis Potosi (Mexico); 22-26 May 1989)			
2	15:2822	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002199	MF-404
CONF-8905192–		(Conference on X-ray microimaging for the life sciences; Berkeley, CA (USA); 24-26 May 1989)			
2	15:3680	*See* UCRL–100702			
CONF-8905194–		(4. Pisa meeting on advanced detectors: frontier detectors from frontier physics; La Biodola (Italy); 21-26 May 1989)			
6	15:3357	*See* SLAC-PUB–5066			
CONF-8905208–		(3. international conference on elastic and diffractive scattering; Evanston, IL (USA); 2-6 May 1989)			
3	15:3981	*See* DOE/ER/40224–108			
CONF-8905223–		(12. Warsaw symposium on elementary particle physics; Kazimierz (Poland); 29 May - 2 jun 1989)			
2	15:3983	*See* DOE/ER/40224–114			
3	15:4017	*See* DOE/ER/40224–115			
4	15:4024	*See* RAL–89-077			
CONF-8905227–		(International conference on radiosurgery a neurosurgical approach to intracranial lesions; Charlottesville, VA (USA); 1-5 May 1989)			
2	15:3745	*See* LBL–27918			
3	15:3677	*See* LBL–27919			
CONF-8905228–		(9. biennial SSI/Princeton conference on space manufacturing; Princeton, NJ (USA); 10 May 1989)			
	15:2295	*See* N–89-27619			
CONF-8905236–		(Royal Swedish Academy of Sciences symposium on interaction mechanisms of low-level electromagnetic fields; Stockholm (Sweden); 25-27 May 1989)			
1	15:3802	*See* LBL–27867			
CONF-8905239–		(3. international meeting on quasicrystals: incommensurate structures in condensed matter; Vista Hermosa (Mexico); 29 May - 2 jun 1989)			
1	15:2823	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002213	MF-401; MF-404
CONF-890555–		(7. power plant dynamics, control and testing symposium; Knoxville, TN (USA); 15-17 May 1989)			
23	15:2478	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002195	MF-530
CONF-890566–		(5. symposium on the medical applications of cyclotrons and technical exhibition; Turku (Finland); 30 May - 2 jun 1989)			
1	15:3102	*See* BNL–43464			
CONF-890604–		(Annual meeting of the American Nuclear Society; Atlanta, GA (USA); 4-8 Jun 1989)			
20	15:3267	*See* UCRL–101915			
CONF-890609–		(ASHRAE annual meeting; Vancouver (Canada); 24-28 Jun 1989)			
6	15:2690	*See* LBL–27534			
CONF-8906112–		(7. symposium on energy engineering sciences; Argonne, IL (USA); 19-21 Jun 1989)			
2	15:3187	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002210	MF-406
CONF-8906119–		(Powder metallurgy conference; San Diego, CA (USA); 11-14 Jun 1989)			
4	15:2909	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002203	MF-201
CONF-890612–		(34. international gas turbine and aeroengine congress and exposition; Toronto (Canada); 4-8 Jun 1989)			
	15:3248	*See* N–89-28030			
CONF-8906154–		(28. Liege international astrophysical colloquium on our changing atmosphere; Liege (Belgium); 26-30 Jun 1989)			
2	15:3406	*See* BNL–43361			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8906160–		(Yamada conference on nuclear weak processes and nuclear structure; Osaka (Japan); 12-15 Jun 1989)			
7	15:4083	*See* DOE/ER/40389–56			
8	15:4127	*See* DOE/ER/40427–12-N9			
CONF-890618–		(NICOLS '89: 9th international conference on laser spectroscopy; Bretton Woods, NH (USA); 18-23 Jun 1989)			
5	15:4234	*See* LBL–26490			
CONF-890619–		(34. annual meeting of the Health Physics Society; Albuquerque, NM (USA); 25-29 Jun 1989)			
9	15:4185	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002509	MF-707
CONF-8906210–		(Workshop on B-factories and related physics issues; Blois (France); 26 Jun - 1 jul 1989)			
3	15:3973	*See* ANL-HEP-CP–89-109			
4	15:3966	*See* SLAC-PUB–5048			
CONF-8906215–		(20. international ICT conference: environmental testing in the 90's; Karlsruhe (Germany, F.R.); Jun 1989)			
1-Rev.	15:3405	*See* BNL–43127-Rev.			
CONF-8906235–		(Symposium on spin and symmetries; Vancouver (Canada); 30 Jun - 2 jul 1989)			
1	15:4023	*See* LBL–27452			
CONF-8906236–		(ARIES meeting; Boston, MA (USA); Jun 1989)			
1	15:4398	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001565	MF-427
CONF-8906238–		(Conference on many-atom interactions in solids; Pajulahti (Finland); 5-9 Jun 1989)			
1	15:4236	*See* UCRL–100752			
CONF-8906239–		(Santa Fe Institute summer school on complex systems; Santa Fe, NM (USA); 5-30 Jun 1989)			
1	15:4285	*See* LA-UR–89-3337			
CONF-8906240–		(8. annual meeting on impact assessment in an age of transformation; Montreal (Canada); 24-28 Jun 1989)			
1	15:2182	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002194	MF-512
CONF-8906241–		(30. annual meeting of the Institute of Nuclear Materials Management; Orlando, FL (USA); 12 Jun 1989)			
1	15:2183	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001771	MF-511
CONF-8906242–		(HAZMAT '89 international conference; Atlantic City, NJ (USA); 13-15 Jun 1989)			
1	15:3494	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002844	
CONF-8906243–		(Conference on industry and pollution prevention; Taipei (Taiwan); 15-16 Jun 1989)			
1	15:3495	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002215	MF-603
CONF-8906244–		(Conference on responding to the threat of global warming: options for the Pacific and Asia; Honolulu, HI (USA); 21-27 Jun 1989)			
1	15:3408	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002170	MF-402
CONF-8906246–		(Quantitative characterization of dynamical complexity in nonlinear systems workshop; Bryn Mawr, PA (USA); 22-24 Jun 1989)			
1	15:2094	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002206	MF-103
CONF-8906247–		(International symposium on physics of new materials; Osaka (Japan); 16 Jun 1989)			
1	15:2824	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002204	MF-411
CONF-8906248–		(Mathematical Sciences Research Institute workshop on geometry of Hamiltonian Systems; Berkeley, CA (USA); 6-15 Jun 1989)			
1	15:4286	*See* LA-UR–89-3465			
CONF-8906249–		(Summer school on numerical analysis; Saclay (France); 12-23 Jun 1989)			
1	15:2516	*See* EGG-EAST–8546			
CONF-890628–		(30. US symposium on rock mechanics; Morgantown, WV (USA); 19-22 Jun 1989)			
1	15:2235	*See* SAND–88-2734			
4	15:2233	*See* SAND–88-2535			
CONF-890659–		(14. annual meeting and international symposium of the Technology Transfer Society; Oak Ridge, TN (USA); 13-16 Jun 1989)			
3	15:2605	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002168	MF-400

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890665–		(7. Institute of Electrical and Electronics Engineers pulsed power conference; Monterey, California, USA; 12-14 Jun 1989)			
31	15:4428	*See* LA-UR–89-1909			
CONF-890673–		(IWGFR specialists meeting on advanced controls for fast reactors; Argonne, IL (USA); 20-22 Jun 1989)			
5	15:2500	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002211	MF-530
CONF-890686–		(International conference on new aspects of nuclear spectroscopy; Crete (Greece); 26-30 Jun 1989)			
3	15:4107	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002208	MF-414
CONF-890701–		(International cryogenic materials conference; Los Angeles, CA (USA); 24-28 Jul 1989)			
	15:2928	*See* N–89-27038			
16	15:2840	*See* LBL–27380			
19	15:3130	*See* LBL–27746			
20	15:3131	*See* LBL–27826			
21	15:3287	*See* FNAL-TM–1623			
CONF-890702–		(28. international geological congress; Washington, DC (USA); 9-19 Jul 1989)			
4	15:2234	*See* SAND–88-2626C			
CONF-890703–		(International conference on ion sources; Berkeley, CA (USA); 10-14 Jul 1989)			
21	15:3891	*See* LBL–27423			
22	15:4439	*See* LBL–27743			
23	15:3305	*See* LBL–27421			
24	15:3306	*See* LBL–27606			
25	15:3301	*See* LBL–26842			
26	15:3303	*See* LBL–26844			
27	15:3302	*See* LBL–26843			
28	15:3304	*See* LBL–27339			
CONF-890708–		(16. international conference on the physics of electronic and atomic collisions; New York, NY (USA); 26 Jul - 1 aug 1989)			
10	15:3077	*See* LBL–27937			
CONF-890710–		(5. international conference on megagauss magnetic field generation and related topics; Novosibirsk (USSR); 3-7 Jul 1989)			
22	15:4445	*See* UCRL–100432			
24	15:3140	*See* UCRL–100641			
CONF-8907103–		(Technology-based confidence building: energy and environment; Santa Fe, NM (USA); 9-14 Jul 1989)			
12	15:3496	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002167	MF-600
CONF-8907113–		(5. international conference on environmental mutagens; Cleveland, OH (USA); 10-15 Jul 1989)			
13	15:3365	NTIS, PC A02/MF A01 - OSTI		DE90002191	MF-408
CONF-8907118–		(25. American Society of Mechanical Engineers joint propulsion conference; Monterey, CA (USA); 10-13 Jul 1989)			
	15:2780	*See* N–89-27700			
CONF-8907127–		(12. few body conference; Vancouver (Canada); 2-8 Jul 1989)			
3	15:3977	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002838	MF-413
4	15:3893	*See* RAL–89-070			
CONF-8907134–		(17. SLAC summer institute: physics at the 100 GeV mass scale; Stanford, CA (USA); 10-21 Jul 1989)			
2	15:3967	*See* SLAC-PUB–5118			
CONF-8907140–		(18. international conference on differential geometric methods in theoretical physics: physics and geometry; Tahoe City, CA (USA); 2-8 Jul 1989)			
3	15:4034	*See* FNAL/C–89/163-T			
CONF-8907161–		(Structures under shock and impact conference; Cambridge, MA (USA); 11-13 Jul 1989)			
1	15:2508	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002187	MF-520
CONF-8907162–		(8. Eloisatron Project workshop on Higgs Boson; Erice (Italy); 15-26 Jul 1989)			
1	15:3953	*See* FNAL/C–89/207-E			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8907163–		(Anniversary Adriatico research conference on strongly correlated electrons; Trieste (Italy); 18-21 Jul 1989)			
1	15:4231	*See* LA-UR–89-3334			
CONF-8907164–		(3. SIAM conference on domain decomposition methods; Society for Industrial and Applied Mathematics (SIAM) national meeting; Houston, TX (USA); San Diego, CA (USA); 20-22 Mar 1989; 16-21 jul 1989)			
1	15:4508	*See* CONF-8903169–2			
CONF-8907165–		(NATO advanced study institute meeting; Istanbul (Turkey); 30 Jul - 12 aug 1989)			
1	15:3079	*See* LBL–27940			
CONF-890718–		(International conference on materials and mechanisms of superconductivity - high-temperature superconductors; Stanford, CA (USA); 23-28 Jul 1989)			
Rev.1	15:4258	*See* UCRL–100596-Rev.1			
CONF-890756–		(17. international symposium on shock waves and shock tubes (STS-17); Bethlehem, PA (USA); 17-21 Jul 1989)			
3	15:3072	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002192	MF-401
CONF-890770–		(Conference on review of progress in quantitative NDE; Brunswick, ME (USA); 23-28 Jul 1989)			
2	15:2915	*See* EGG-M–89119			
3	15:3213	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002184	MF-364
4	15:2834	*See* EGG-M–89209			
5	15:2916	*See* EGG-M–89153			
6	15:2849	*See* PNL-SA–17443			
CONF-890790–		(5. world conference on transport research; Yokohama (Japan); 10-14 Jul 1989)			
3	15:2709	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002190	MF-335
CONF-890802–		(7. synchrotron radiation instrumentation (SRI) national conference; Berkeley, CA (USA); 6-10 Aug 1989)			
15	15:4204	*See* BNL–43345			
16	15:3266	*See* LBL–27763			
CONF-890803–		(International conference on high energy accelerators; Tsukuba (Japan); 20-26 Aug 1989)			
35	15:3307	*See* LBL–27664			
37	15:3265	*See* LBL–27649			
38	15:3272	*See* LBL–27765			
39	15:3278	*See* SLAC-PUB–5086			
40	15:3277	*See* SLAC-PUB–5060			
41	15:3273	*See* LBL–27766			
CONF-890807–		(Symposium on reclamation: a global perspective; Calgary (Canada); 27-30 Aug 1989)			
	15:2079	*See* RRTAC–89-2			
CONF-8908106–		(Los Alamos workshop on quantum simulations of condensed matter phenomena; Los Alamos, NM (USA); 8-11 Aug 1989)			
5	15:4235	*See* LBL–27806			
CONF-8908116–		(15. international conference on very large data bases; Amsterdam (Netherlands); 22-25 Aug 1989)			
2	15:4543	*See* LBL–26600			
CONF-890812–		(American Physical Society topical conference on shock compression of condensed matter; Albuquerque, NM (USA); 14-17 Aug 1989)			
62	15:3221	*See* UCRL–100810			
CONF-890813–		(7. international conference on dynamical processes in excited states of solids; Athens, GA (USA); 28 Aug - 2 sep 1989)			
1	15:4237	*See* UCRL–101088			
CONF-8908131–		(2. LAMPF workshop on pion-nucleus double charge exchange; Los Alamos, NM (USA); 9-11 Aug 1989)			
3	15:4160	*See* LA-UR–89-3638			
CONF-8908133–		(24. Yamada conference on strongly coupled plasma physics; Tokyo (Japan); 29 Aug - 2 sep 1989)			
6	15:4208	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002172	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8908133–					
7	15:2910	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002778	MF-404
CONF-8908134–		(11. international free electron laser conference; Naples, FL (USA); 28 Aug - 1 sep 1989)			
8	15:3159	*See* LA-UR–89-3438			
9	15:3158	*See* LA-UR–89-3406			
10	15:3298	*See* LA-UR–89-3397			
11	15:3157	*See* LA-UR–89-3395			
12	15:3156	*See* LA-UR–89-3394			
15	15:3167	*See* UCRL–100891			
16	15:3160	*See* LA-UR–89-3581			
CONF-890814–		(American Institute of Chemical Engineer's summer national meeting; Philadelphia, PA (USA); 20-23 Aug 1989)			
9	15:3407	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002178	MF-630
CONF-8908144–		(SAE conference and expo on future transportation technology; Vancouver (Canada); 6-10 Aug 1989)			
3	15:2792	*See* EGG-M–89258			
CONF-8908145–		(4. workshop on RF superconductivity; Ibaraki-Ken (Japan); 14-18 Aug 1989)			
4	15:3128	*See* LA-UR–89-3331			
5	15:3129	*See* LBL–27627			
CONF-8908148–		(International workshop on relativistic aspects of nuclear physics; Rio de Janeiro (Brazil); 28-31 Aug 1989)			
2	15:4067	*See* LBL–27885			
CONF-8908168–		(AIChE meeting on controls of accidental releases of hazardous gases; Philadelphia, PA (USA); Aug 1989)			
2	15:3469	*See* UCRL–101996			
CONF-8908170–		(3. international conference on synchrotron radiation instrumentation; Tsukuba (Japan); 29 Aug - 2 sep 1989)			
2	15:3318	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002179	MF-406
CONF-8908173–		(6. Nordic meeting on nuclear physics; Kopervik (Norway); 10-15 Aug 1989)			
1	15:4123	*See* BNL–43385			
2	15:4066	*See* LBL–27833			
CONF-8908175–		(International workshop on intermediate-temperature embrittlement processes in duplex stainless steels; Oxford (UK); 1-2 Aug 1989)			
1	15:2825	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002777	
CONF-8908176–		(Waters '89: international GPC symposium; Newton, MA (USA); 28 Aug 1989)			
1	15:3063	*See* KCP–613-4127			
CONF-8908177–		(24. intersociety energy conversion engineering conference; Washington, DC (USA); 6-11 Aug 1989)			
	15:2416	*See* N–89-27702			
1	15:2759	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001769	
CONF-8908178–		(International conference on nonlinear diffusion equations and their equilibrium states; Newton (UK); 20-29 Aug 1989)			
1	15:4510	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001772	MF-405
CONF-8908179–		(Conference on maximum entropy and bayesian methods; Hanover, NH (USA); 14-18 Aug 1989)			
1	15:4261	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002839	MF-404
2	15:2969	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002840	MF-404
CONF-8908184–		(3. Brazilian Congress of Physicists in Medicine; Aguas de Lindoia (Brazil); 23-26 Aug 1989)			
	15:3335	*See* INIS-BR–1748			
	15:3336	*See* INIS-BR–1749			
	15:3337	*See* INIS-BR–1750			
	15:4189	*See* INIS-BR–1747			
CONF-890821–		(13. international conference on atomic collisions in solids; Aarhus (Denmark); 7-11 Aug 1989)			
6	15:4205	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002841	MF-411
CONF-890826–		(International nuclear physics conference; Sao Paulo (Brazil); 20-26 Aug 1989)			
5	15:3316	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002174	MF-413
6	15:3828	*See* LBL–27747			
7	15:4162	*See* LBL–27881			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890836–		(33. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA (USA); 6-11 Aug 1989)			
18	15:4451	*See* UCRL–101649			
CONF-890841–		(International workshop on safety of nuclear installations of the next generation and beyond; Chicago, IL (USA); 28-31 Aug 1989)			
3	15:2501	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002175	MF-542
4	15:2502	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002177	MF-542
CONF-890850–		(11. international conference on magnet technology; Tsukuba (Japan); 28 Aug - 1 sep 1989)			
4	15:4446	*See* UCRL–100533			
CONF-890854–		(11. annual DOE low level waste management conference; Pittsburgh, PA (USA); 22-24 Aug 1989)			
14	15:2231	*See* PNL-SA–17267			
CONF-890855–		(10. international conference on Structural Mechanics in Reactor Technology (SMIRT); Anaheim, CA (USA); 14-18 Aug 1989)			
57	15:2503	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001770	MF-520
58	15:2504	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001768	MF-523
CONF-890867–		(6. international symposium on water-rock interaction; Malvern (UK); 3-9 Aug 1989)			
3	15:2240	*See* UCRL–101285			
CONF-890872–		(Workshop on physics at Fermilab in the 1990's; Breckenridge, CO (USA); 15-24 Aug 1989)			
2	15:4044	*See* LA-UR–89-3537			
3	15:3950	*See* DOE/ER/40389–61			
CONF-890876–		(Waterpower '89: international conference on hydropower; Buffalo, NY (USA); 23-25 Aug 1989)			
3	15:2277	*See* EGG-M–89101			
CONF-890884–		(Bioprocessing of fossil fuels workshop; Arlington, VA (USA); 8-11 Aug 1989)			
2	15:2107	*See* BNL–43128			
CONF-890899–		(Joint Korea-United States seminar on expert systems for electric power systems and industries; Seoul (Republic of Korea); 13-18 Aug 1989)			
2	15:2505	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002171	MF-541
CONF-890902–		(198. American Chemical Society national meeting; Miami, FL (USA); 10-15 Sep 1989)			
20	15:4101	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001079	MF-413
CONF-890903–		(International Europhysics conference on high-energy physics; Madrid (Spain); 7-14 Sep 1989)			
2	15:3260	*See* ANL-HEP-CP–89-122			
CONF-890906–		(11. international vacuum congress and 7th international conference on solid surfaces; Cologne (Germany, F.R.); 25-29 Sep 1989)			
5	15:3314	*See* BNL–43347			
6	15:3285	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002428	MF-414
CONF-8909110–		(16. annual conference of the American Society for Quality Control; Fort Lauderdale, FL (USA); 17-20 Sep 1989)			
8	15:4495	*See* PNL-SA–17004			
9	15:2753	*See* PNL-SA–16968			
CONF-8909123–		(Meeting of the International Nuclear Law Association; Tokyo (Japan); 25-28 Sep 1989)			
1	15:2615	*See* PNL-SA–16907			
CONF-8909128–		(Oceans '89 conference; Seattle, WA (USA); 18-21 Sep 1989)			
6	15:3819	*See* PNL-SA–17111			
CONF-8909141–		(12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989)			
3	15:2458	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001442	MF-940
7	15:2488	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001759	MF-525
8	15:2489	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001761	MF-940
5-Draft	15:2164	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001435	MF-532
CONF-8909163–		(5. symposium on containment of underground nuclear detonations; Santa Barbara, CA (USA); 19-21 Sep 1989)			
6	15:3516	*See* UCRL–100936			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8909172–		(SIMS VII: 7th international conference on secondary ion mass spectrometry; Monterey, CA (USA); 3-8 Sep 1989)			
3	15:2856	*See* UCRL–100797			
CONF-8909181–		(Electric and hybrid vehicle contractors' meeting; Idaho Falls, ID (USA); 6-8 Sep 1989)			
6	15:2793	*See* EGG-M–89361			
CONF-8909216–		(DARPA/SDIO service annual charged particle beam review; Monterey, CA (USA); 18-21 Sep 1989)			
8	15:3274	*See* SAND–89-2629C			
9	15:3895	*See* SAND–89-2668C			
10	15:3275	*See* SAND–89-7141C			
CONF-8909221–		(HADRON '89: 3rd international conference on hadron spectroscopy; Ajaccio (France); 23-27 Sep 1989)			
2	15:3986	*See* FNAL/C–89/232-T			
CONF-8909229–		(Aeroballistic Range Association meeting; Paris (France); 24-28 Sep 1989)			
2	15:3220	*See* SAND–89-2198C			
CONF-8909236–		(JAERI/EPA workshop on residual radiation and recycle criteria; St. Michaels, MD (USA); 27-28 Sep 1989)			
2	15:3693	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002429	MF-721
CONF-8909242–		(National Association of Regulatory Utility Commissioners conference; Charleston, SC (USA); 10-13 Sep 1989)			
1	15:2632	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001642	MF-400
2	15:2633	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002489	MF-400
CONF-8909243–		(Global natural resource monitoring and assessments: preparing for the 21st century; Venice (Italy); 24-30 Sep 1989)			
2	15:3751	*See* PNL-SA–17026			
CONF-8909244–		(International heavy particle therapy workshop; Villigen (Switzerland); 18-20 Sep 1989)			
1	15:3619	*See* FNAL-TM–1622			
CONF-8909246–		(Magnetic recording media conference; Rimini (Italy); 4-6 Sep 1989)			
1	15:4521	*See* LBL–27680			
CONF-8909247–		(ACS symposium on exotic nuclear spectroscopy; Miami Beach, FL (USA); 11-15 Sep 1989)			
1	15:4125	*See* DOE/ER/40417–4			
3	15:3070	*See* BNL–42573			
CONF-8909248–		(6. international RETRAN meeting; Arlington, VA (USA); 18-20 Sep 1989)			
1	15:2496	*See* BNL–43298			
CONF-8909250–		(Radon contractors conference; Fort Collins, CO (USA); 20-22 Sep 1989)			
1	15:2691	*See* LBL–27692			
CONF-8909252–		(14. annual Japanese Society for Biomedical Mass Speculation meeting; Nagoya (Japan); 28-30 Sep 1989)			
1	15:3371	*See* PNL-SA–17257			
CONF-8909254–		(Forecasting in the Transportation Sector session; Philadelphia, PA (USA); 27-28 Sep 1989)			
1	15:2591	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001982	MF-330
CONF-8909256–		(Symposium on biosensors; Chapel Hill, NC (USA); 7-9 Sep 1989)			
1	15:3600	*See* BNL–43112			
CONF-8909257–		(International symposium and team workshop on 3-D electromagnetic field analysis (3DMAG); Okayama (Japan); 11-13 Sep 1989)			
1	15:4303	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001764	MF-420
CONF-890926–		(9. international symposium on detonation; Portland, OR (USA); Sep 1989)			
3	15:3382	*See* UCRL–101879			
CONF-8909260–		(21. international conference of the Society for the Advancement of Materials and Process Engineering (SAMPE); Atlantic City, NJ (USA); 25-28 Sep 1989)			
	15:2973	*See* N–89-26918			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8909261–		(Workshop on field-scale water and solute flux in soils; Monte Verita (Switzerland); 24-29 Sep 1989)			
1	15:2201	*See* LA-UR–89-3354			
CONF-8909262–		(Muon catalyzed fusion meeting; Oxford (UK); 10-13 Sep 1989)			
1	15:4073	*See* LA-UR–89-3535			
CONF-8909263–		(6. edition of the University of Gandia summer colloquium; Valencia (Spain); 4-9 Sep 1989)			
1	15:2509	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001760	MF-530
CONF-890928–		(Nuclear waste isolation in the unsaturated zone: FOCUS '89; Las Vegas, NV (USA); 18-21 Sep 1989)			
11	15:2202	*See* LA-UR–89-3355			
12	15:2204	*See* LA-UR–89-3503			
13	15:3812	*See* LBL–27778			
14	15:2227	*See* PNL-SA–16734			
15	15:2210	*See* LBL–26828			
16	15:2209	*See* LBL–26827			
CONF-890931–		(13. conference on the numerical simulation of plasmas; Santa Fe, NM (USA); 17-20 Sep 1989)			
9	15:4450	*See* UCRL–101481			
CONF-890939–		(International conference on high T_c thin films and single crystals; Ustron (Poland); 30 Sep - 4 oct 1989)			
2	15:4254	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002842	MF-401; MF-404
CONF-890953–		(International conference on the physics of highly correlated electron systems; Santa Fe, NM (USA); 11-15 Sep 1989)			
9	15:4232	*See* LA-UR–89-3361			
11	15:2904	*See* BNL–43373			
CONF-890960–		(6. international symposium on passivity: passivation of metals and semiconductors; Sapporo (Japan); 24-28 Sep 1989)			
1-Rev.	15:2903	*See* BNL–42550-Rev.			
CONF-890964–		(4. annual hazardous waste and hazardous materials management conference and exposition; San Francisco, CA (USA); 27-29 Sep 1989)			
1	15:2229	*See* PNL-SA–16844			
CONF-890977–		(International congress on intergranular and interphase boundaries in materials; Paris (France); 4-8 Sep 1989)			
2	15:2841	*See* LBL–27834			
CONF-890979–		(Fundamental symmetries in nuclei and particles; Pasadena, CA (USA); 7-9 Sep 1989)			
1	15:3959	*See* LA-UR–89-3695			
CONF-890981–		(Windpower '89; San Francisco, CA (USA); 24-27 Sep 1989)			
3	15:2384	*See* SERI/TP–257-3591			
4	15:2381	*See* PNL-SA–17250			
CONF-890982–		(International meeting on neutron activation cross sections for fission and fusion energy applications; Argonne, IL (USA); 11-15 Sep 1989)			
5	15:4111	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001919	MF-413
6	15:4429	*See* LA-UR–89-3068			
CONF-891001–		(International conference on coal science; Tokyo (Japan); 23-27 Oct 1989)			
9	15:2051	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002862	MF-401
10	15:2052	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002863	MF-401
CONF-891006–		(Joint international waste management conference; Kyoto (Japan); 23-28 Oct 1989)			
8	15:2226	*See* PNL-SA–16209			
CONF-891007–		(13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989)			
31	15:4387	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002150	MF-422
48	15:4433	*See* LA-UR–89-3289			
53	15:4430	*See* LA-UR–89-3268			
56	15:4431	*See* LA-UR–89-3275			
58	15:4432	*See* LA-UR–89-3277			
64	15:4437	*See* LA-UR–89-3407			

CONF-891007–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
69	15:4435	*See* LA-UR–89-3297			
71	15:4434	*See* LA-UR–89-3292			
72	15:4388	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002470	MF-420
74	15:4342	*See* LA-UR–89-3174			
75	15:4389	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002464	MF-423
76	15:4436	*See* LA-UR–89-3342			
77	15:4390	NTIS, PC A02/MF A01: OSTI; INIS; GPO Dep.	E 1.99:	DE90002488	MF-420
78	15:4391	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002487	MF-420
79	15:4447	*See* UCRL–101113			
80	15:4448	*See* UCRL–101145			
81	15:4449	*See* UCRL–101148			
82	15:4452	*See* UCRL–101756			
83	15:4392	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002714	MF-426
84	15:4393	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002848	MF-424
85	15:4394	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002710	MF-420
86	15:4415	*See* GA-A–19756			
87	15:4358	*See* UCRL–101105			
88	15:4395	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003077	MF-423
89	15:4414	*See* GA-A–19752			
90	15:4413	*See* GA-A–19751			
91	15:4412	*See* GA-A–19748			
92	15:4411	*See* GA-A–19747			
93	15:4409	*See* GA-A–19741			
94	15:4407	*See* GA-A–19739			
95	15:4410	*See* GA-A–19742			
96	15:4408	*See* GA-A–19740			
CONF-8910107–		(Electrochemical Society fall meeting; Hollywood, FL (USA); 15-20 Oct 1989)			
2	15:2655	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001914	
3	15:2659	*See* PNL-SA–17036			
CONF-8910120–		(1. international ceramic science and technology congress; Anaheim, CA (USA); 31 Oct - 3 nov 1989)			
1	15:2911	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001963	MF-310
3	15:2912	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002706	MF-404
CONF-8910121–		(6. topical conference on physics with polarized beams on polarized targets; Spencer, IN (USA); 16-18 Oct 1989)			
1	15:3271	*See* LA-UR–89-3600			
CONF-891013–		(6. symposium on separation science and technology for energy applications; Knoxville, TN (USA); 22-27 Oct 1989)			
6	15:2203	*See* LA-UR–89-3410			
7	15:3073	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002480	MF-401
CONF-8910157–		(American Defense Preparedness Association's (ADPA) international joint symposium on compatibility of plastics and other materials with explosives, propellants and pyrotechnics, and processing propellants, explosives, and ingredients; Virginia Beach, VA (USA); 23-25 Oct 1989)			
3	15:3380	*See* MLM–3612(OP)			
CONF-891018–		(MMIJ/IMM joint symposium on today's technology for the mining and metallurgical industries; Kyoto (Japan); 2-4 Oct 1989)			
1	15:2083	*See* DOE/PC/88939–5			
CONF-8910187–		(6. annual conference on electron beam melting and refining: state of the art; Reno, NV (USA); 29-31 Oct 1989)			
1	15:3898	*See* UCRL–101247-Pts.1-2			
CONF-8910192–		(2. DOE natural phenomena hazards mitigation conference; Knoxville, TN (USA); 3-5 Oct 1989)			
15	15:3807	*See* EGG-M–89182			
16	15:3808	*See* EGG-M–89193			
CONF-8910193–		(DOE model conference; Oak Ridge, TN (USA); 2-6 Oct 1989)			
4	15:3801	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003060	MF-721
CONF-8910216–		(Ultrasonics symposium; Montreal (Canada); 3 Oct 1989)			
3	15:3366	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002773	MF-125

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8910222–		(17. water reactor safety information meeting; Rockville, MD (USA); 23-25 Oct 1989)			
2	15:2476	*See* SAND–89-1755C			
3	15:2510	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001975	
4	15:2511	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002478	
5	15:2437	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002477	
6	15:2479	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002482	
CONF-8910228–		(DOE quality assurance workshop; Idaho Falls, ID (USA); 3-4 Oct 1989)			
1	15:4491	*See* FNAL/C–89/194			
CONF-8910237–		(International school seminar on heavy ion physics; Dubna (USSR); 3-12 Oct 1989)			
3	15:4122	*See* UCRL–100763			
4	15:4099	*See* LBL–27894			
CONF-8910239–		(13. annual TRADE conference; Baltimore, MD (USA); 22-25 Oct 1989)			
3	15:2184	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002087	MF-402
4	15:2460	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002775	MF-500
5	15:2512	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002711	MF-600
6	15:4532	*See* WHC-SA–0726			
CONF-8910243–		(European space power conference; Madrid (Spain); 2-6 Oct 1989)			
	15:2296	*See* N–89-27705			
CONF-8910248–		(Annual automotive technology development contractors coordination meeting; Dearborn, MI (USA); 23-26 Oct 1989)			
1	15:2913	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001645	MF-336
CONF-8910259–		(IAEA technical committee meeting on alpha particles/confinement and heating; Kiev (USSR); 23-26 Oct 1989)			
2	15:4312	*See* GA-A–19860			
1-Vugraphs	15:4304	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001730	MF-420
CONF-8910260–		(Plutonium/uranium recovery operations conference; Oak Ridge, TN (USA); 24-26 Oct 1989)			
1	15:2165	*See* WSRC-RP–89-355			
CONF-8910263–		(JANNAF Combustion Subcommittee meeting; Pasadena, CA (USA); 23-27 Oct 1989)			
1	15:3381	*See* SAND–89-1437C			
CONF-8910264–		(Asilomar conference on signals, systems and computers; Monterey, CA (USA); 31 Oct 1989)			
1	15:4288	*See* SAND–89-2525C			
CONF-891027–		(International symposium on research reactor safety, operations and modifications; Chalk River (Canada); 23-27 Oct 1989)			
6	15:2528	*See* IAEA-SM–310/63P			
CONF-8910271–		(North American Zeiss User's Group conference; Newport Beach, CA (USA); 14 Oct 1989)			
1-Vugraphs	15:4524	*See* RFP–4368			
CONF-8910272–		(7. annual membrane technology/planning conference; Cambridge, MA (USA); 17-19 Oct 1989)			
1	15:2728	*See* EGG-M–89322			
CONF-8910273–		(Symposium on atomic migration and defects in materials; Indianapolis, IN (USA); 1-5 Oct 1989)			
1	15:2914	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001931	MF-401; MF-404
CONF-8910274–		(15. MPA seminar on safety and reliability of plant technology; Stuttgart (Germany, F.R.); 5-6 Oct 1989)			
1	15:2513	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001928	
2	15:2442	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001942	
CONF-8910275–		(Electric Power Research Institute PCB seminar; San Diego, CA (USA); 3-6 Oct 1989)			
1	15:3759	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001912	MF-401
CONF-8910276–		(4. international workshop on desorption induced by electronic transitions; Gloggnitz (Austria); 2-4 Oct 1989)			
1	15:4209	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001938	MF-411
CONF-8910277–		(11. conference of probability and statistics; Monterey, CA (USA); 1-5 Oct 1989)			
1	15:2230	*See* PNL-SA–17164-HEDR			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8910280–		(1. international conference on chlorine in coal; Joint meeting of the U.S. DOE (PETC)/Japan AIST-NEDO Committee on Coal Liquefaction; Chicago, IL (USA); Tokyo (Japan); 9-11 Oct 1989; 27 oct - 10 nov 1)			
1	15:2018	*See* CONF-891079–1			
CONF-8910282–		(Workshop on momentum distributions; Argonne, IL (USA); 24-26 Oct 1989)			
1	15:4255	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002776	MF-404
CONF-8910283–		(Forum on electronic product definition standards; Gaithersburg, MD (USA); 26 Oct 1989)			
1	15:4527	*See* SAND–89-2533C			
CONF-8910284–		(Aerospace applications of artificial intelligence conference; Dayton, OH (USA); 24-27 Oct 1989)			
1	15:4511	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002472	
CONF-8910285–		(Symposium on daylighting and solar radiation measurement; Berlin (Germany, F.R.); 9-11 Oct 1989)			
1	15:2699	*See* PNL-SA–17311			
CONF-8910287–		(1. regional meeting of the American Filtration Society; Houston, TX (USA); 30 Oct - 1 nov 1989)			
1	15:3041	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002845	MF-601
CONF-8910288–		(North American conference on logic programming; Cleveland, OH (USA); 16-20 Oct 1989)			
1	15:4512	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002861	MF-405
CONF-8910289–		(Western States Section meeting of the Combustion Institute; Livermore, CA (USA); 23-24 Oct 1989)			
2	15:3108	*See* LBL–27904			
CONF-8910290–		(36. Sagamore conference on thick section composites; Plymouth, MA (USA); 23-26 Oct 1989)			
1	15:2988	*See* UCRL–102028			
CONF-8910294–		(Conference on AI in the DOE complex; Los Alamos, NM (USA); 17-19 Oct 1989)			
1	15:4515	*See* EGG-M–89380			
CONF-8910295–		(8. international conference on entity-relationship approach; Toronto (Canada); 18-20 Oct 1989)			
1	15:4542	*See* LBL–25337			
CONF-891030–		(AIAA computers in aerospace conference; Monterey, CA (USA); Oct 1989)			
2	15:4161	*See* LBL–27874			
CONF-891036–		(Joint American Society of Mechanical Engineers/Society of Tribologists and Lubrication Engineers tribology conference; Ft. Lauderdale, FL (USA); 16-19 Oct 1989)			
2	15:2906	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002860	MF-373
CONF-891046–		(Advanced research and technology development; Morgantown, WV (USA); 3-5 Oct 1989)			
4	15:2053	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002774	MF-115
CONF-891049–		(Society of Petroleum Engineers annual technical conference and exhibition; San Antonio, TX (USA); 8-11 Oct 1989)			
3	15:2111	*See* LBL–27729			
CONF-891053–		(28. Hanford life sciences symposium on environmental monitoring, restoration and assessment: what have we learned?; Richland, WA (USA); 16-19 Oct 1989)			
3	15:3515	*See* PNL-SA–16766			
5	15:2180	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001940	MF-511
7	15:2232	*See* PNL-SA–17359			
8	15:2598	*See* PNL-SA–16875			
9	15:3488	*See* PNL-SA–17367			
10	15:3501	*See* PNL-SA–16809			
11	15:3464	*See* PNL-SA–17385			
CONF-891057–		(3. international symposium on borehole geophysics; Las Vegas, NV (USA); 2-5 Oct 1989)			
3	15:3390	*See* UCRL–100794			
CONF-891072–		(27. Hanford symposium on health and the environment: multilevel research–molecules to man; Richland, WA (USA); 18-20 Oct 1989)			
2	15:4540	*See* EGG-M–89437			
3	15:3749	*See* PNL-SA–16859-HEDR			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
4	15:3750	*See* PNL-SA–16874-HEDR			
6	15:2228	*See* PNL-SA–16826			
CONF-891079–		(1. international conference on chlorine in coal; Joint meeting of the U.S. DOE (PETC)/Japan AIST-NEDO Committee on Coal Liquefaction; Chicago, IL (USA); Tokyo (Japan); 9-11 Oct 1989; 27 oct - 10 nov 1)			
1	15:2018	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002707	MF-114; MF-108
CONF-891087–		(IEEE nuclear science symposium and exhibits; San Francisco, CA (USA); 25-27 Oct 1989)			
8	15:3378	*See* LA-UR–89-3498			
9	15:3482	*See* LA-UR–89-3431			
10	15:3354	*See* LBL–27813			
CONF-891090–		(Conference on monitoring and control of plasma-enhanced processing and multichamber growth of semiconductors; Santa Clara, CA (USA); 8-13 Oct 1989)			
1	15:2921	*See* LA-UR–89-3616			
CONF-891093–		(36. American Vacuum Society national vacuum symposium; Boston, MA (USA); 23-27 Oct 1989)			
7	15:4253	*See* BNL–43372			
9	15:4396	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002479	MF-420
11	15:2818	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002859	MF-401; MF-411
13	15:2855	*See* UCRL–98780			
CONF-891097–		(High powered microwave and broadband radio frequency propagation/phenomenology/methodology workshop; Livermore, CA (USA); 23-26 Oct 1989)			
1	15:3227	*See* SAND–89-2542C			
CONF-891103–		(Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989)			
34	15:2459	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001920	MF-500
37	15:2194	*See* EGG-M–89302			
38	15:2438	*See* EGG-M–89186			
41	15:2212	*See* LBL–27429			
44	15:3125	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003067	MF-600
45	15:2211	*See* LBL–27225			
46	15:2171	*See* WHC-SA–0616			
CONF-891106–		(31. annual meeting of the Division of Plasma Physics of the American Physical Society; Anaheim, CA (USA); 13-17 Nov 1989)			
3	15:4301	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002934	MF-420
CONF-8911102–		(IEEE international conference on systems, man and cybernetics; Cambridge, MA (USA); 14-17 Nov 1989)			
1	15:3138	*See* SAND–89-0319C			
CONF-8911105–		(ECNE national conference on demand-side management; Boston, MA (USA); 16-17 Nov 1989)			
1	15:2636	*See* LBL–27748			
CONF-8911106–		(3. national conference on the management of hazardous wastes; Melborune (Australia); 19-21 Nov 1989)			
1	15:3497	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002273	MF-407
CONF-8911107–		(Workshop on clean technology; Bangkok (Thailand); 6-8 Nov 1989)			
1	15:2013	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001926	MF-101
CONF-8911108–		(Superfund '89 conference; Silver Spring, MD (USA); 27-29 Nov 1989)			
1	15:2592	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001909	
CONF-8911109–		(10. DOE Atomic Physics Program workshop; Berkeley, CA (USA); 8-9 Nov 1989)			
1	15:4210	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001906	MF-411
CONF-8911110–		(Symposium on environmental perspectives towards the year 2000 and beyond; Bangkok (Thailand); 6-10 Nov 1989)			
1	15:2185	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001905	MF-402
CONF-8911113–		(Institute of Industrial Engineers conference; Atlanta, GA (USA); 14 Nov 1989)			
1	15:4536	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002717	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8911114–		(EVALMAT '89: International conference on evaluation of materials performance in severe environments; Kobe (Japan); 20-23 Nov 1989)			
1	15:2826	NTIS (US Sales Only), PC A02/MF A01 - OSTI		DE90002155	
CONF-8911117–		(Conference on energy in Milan: the past, the present, and the future of energy in a modern city; Milan (Italy); 10-11 Nov 1989)			
1	15:2593	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002469	MF-400
CONF-8911118–		(2. symposium on user experience with elastic-plastic test methods; Orlando, FL (USA); 8-9 Nov 1989)			
1	15:2833	*See* EGG-M–88501			
CONF-8911121–		(2. international symposium on new glass; Tokyo (Japan); 29-30 Nov 1989)			
1	15:3168	*See* UCRL–102044			
CONF-891113–		(American Institute of Chemical Engineers annual meeting; San Francisco, CA (USA); 5-10 Nov 1989)			
5	15:2654	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001910	
6	15:2409	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002494	MF-113
7	15:3207	*See* UCRL–100847			
CONF-891117–		(34. conference on magnetism and magnetic materials; Boston, MA (USA); 28 Nov - 1 dec 1989)			
6	15:2812	*See* BNL–43108			
7	15:4256	*See* LA-UR–89-3380			
8	15:2819	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002474	MF-404
CONF-891119–		(Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989)			
4	15:2907	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002929	MF-404
5	15:2308	*See* SERI/TP–211-3595			
6	15:2908	NTIS, PC A02/MF A01; OSTI; INIS		DE90003065	MF-404
8	15:2853	*See* SAND–89-1711C			
9	15:2852	*See* SAND–89-1665C			
10	15:2922	*See* LA-UR–89-4011			
CONF-891132–		(9. battery and electrochemical contractors' conference; Alexandria, VA (USA); 13-17 Nov 1989)			
7	15:2573	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001911	MF-212
8	15:2574	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001918	
CONF-891140–		(Session on thermal-hydraulic aspects of passive safety and new generalization reactors; San Francisco, CA (USA); 27-30 Nov 1989)			
3	15:2506	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001924	MF-542
4	15:2507	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001922	MF-530
CONF-891149–		(Supercomputing '89 conference; Reno, NV (USA); 13-17 Nov 1989)			
10-Rev.1	15:4531	*See* UCRL–99673-Rev.1			
CONF-891197–		(Topical meeting on non-destructive assay of radioactive waste; Cadarache (France); 20-22 Nov 1989)			
2	15:2181	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003076	MF-721
3	15:2246	*See* LA-UR–89-3699			
CONSERV-SOLAR-RR–					
5	15:2694	*See* PB–89-184428/XAB			
COO–					
60549-3	15:3412	*See* DOE/ER/60549–3			
60549-4	15:3413	*See* DOE/ER/60549–4			
CPDG–					
(88)-P118	15:2175	*See* AEEW-M–2536			
CPS–					
89-009	15:3117	*See* AD-A–210345/5/XAB			
CRIE-T–					
87066	15:2656	NTIS (US Sales Only), PC A03/MF A01		DE89901266	
CRN-PN–					
85-31	15:4088	NTIS (US Sales Only), PC A08/MF A01		DE90721092	
CRN-RA–					
1987	15:4485	NTIS (US Sales Only), PC A16/MF A01		DE90721245	
CSSA-ASTRO–					
89-03	15:3850	*See* N–89-27629			
CSTB-PC–					
661	15:2664	NTIS (US Sales Only), PC A14/MF A01		DE89908088	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CTA-IEAv-RP–					
018/85	15:4032	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607090	
CTH-JVG–					
27	15:2351	NTIS (US Sales Only), PC A03/MF A01		DE90719416	
DCN–					
88-218-043-43	15:2143	*See* PB–89-230627/XAB			
DNE–					
40	15:2248	*See* CNEN-NE–1.13			
41	15:3475	*See* CNEN-NE–1.22			
DOD–					
5200-1-PH-2	15:2611	*See* PB–89-185763/XAB			
DOE-RW–					
88.045	15:3124	*See* AEEW-R–2033			
89.004	15:2179	*See* AERE-R–12955			
89.025(pt.2)	15:2178	*See* AERE-R–12939			
DOE-tr–					
89-0021	15:3806	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002699	MF-900
89-4	15:3415	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002739	MF-902
89-5	15:4400	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002743	MF-910
89-7	15:4401	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002744	MF-910
89-18	15:2353	NTIS, PC A03/MF A01 - OSTI		DE90002697	MF-920
89-34	15:3618	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002745	MF-908
89-39	15:4402	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002749	MF-910
89-40	15:2784	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002748	MF-920
89-46	15:4403	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002751	MF-900
DOE/BP–					
1177	15:2606	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002852	MF-920
1193	15:2665	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002855	MF-920
1211	15:2607	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002857	MF-900
1223	15:2643	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002856	MF-900
1236	15:2666	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002853	MF-920
1256	15:2667	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002854	MF-920
1273	15:2668	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002851	MF-902; MF-907
1274	15:2669	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002850	MF-902; MF-907
DOE/BP/11287–					
12	15:2670	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002779	MF-630
DOE/BP/12659–					
5	15:2278	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002772	MF-902
DOE/BP/23169–					
2	15:3224	NTIS, PC A11/MF A01 - OSTI		DE90002771	MF-920
DOE/BP/35245–					
2	15:2279	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002782	MF-908
DOE/BP/35571–					
1	15:2724	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002800	MF-920
DOE/BP/39643–					
3	15:2280	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002783	MF-908
DOE/BP/65903–					
2	15:2281	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002781	MF-902
DOE/CE–					
0256-1	15:2827	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003277	MF-312
DOE/CE/15407–					
T1	15:2725	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016440	MF-350
T2	15:2671	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002561	MF-350
DOE/CE/15449–					
T1	15:2563	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001469	MF-330
DOE/CE/34002–					
1	15:3225	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003259	MF-220
DOE/CE/64615–					
T2-Exec.Summ.	15:2621	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE89009245	MF-350
DOE/CH/10093–					
57	15:2118	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009464	MF-311
DOE/DP/50066–					
T1	15:2803	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002551	MF-700
DOE/EH–					
0101	15:2514	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001892	MF-630
DOE/EIA–					
0109(89/08)	15:2628	NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90002595	MF-950
0130(89/08)	15:2629	NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90002592	MF-950

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/EIA–					
0145(88)	15:2149	NTIS, PC A11/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90003070	MF-950
0202(89/4Q)	15:2623	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90002872	MF-950
0219(88)	15:2630	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002569	MF-950
0226(89/08)	15:2634	NTIS, PC A09/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90003093	MF-950
0321/1(87)	15:2672	NTIS, PC A13/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90001588	MF-950
0380(89/08)	15:2125	NTIS, PC A09/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE90002807	MF-950
DOE/ER–					
0184/5	15:2608	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002688	MF-400
0412	15:3943	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001784	PC-412; PC-414
0425	15:3409	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001791	PC-402
DOE/ER/03956–					
T4	15:3978	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE89004682	MF-414
DOE/ER/05490–					
107	15:3944	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002525	MF-414
DOE/ER/13277–					
T2	15:2828	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002770	MF-401
DOE/ER/13295–					
3	15:3074	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002767	MF-401
DOE/ER/13471–					
T2	15:3107	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003095	MF-401
DOE/ER/13472–					
3	15:3805	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003659	MF-410
DOE/ER/13581–					
3	15:3602	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002544	MF-408
DOE/ER/13632–					
3	15:4211	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002705	MF-411
DOE/ER/13695–					
T1	15:3095	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002873	MF-401
DOE/ER/13711–					
1	15:2358	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003047	MF-403
DOE/ER/13732–					
2	15:2970	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002562	MF-401
DOE/ER/13777–					
2	15:2054	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003355	MF-401
DOE/ER/13855–					
2	15:3075	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002882	MF-401
DOE/ER/13897–					
10	15:4262	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002522	MF-410
DOE/ER/25068–					
1	15:4513	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002694	MF-405
DOE/ER/40150–					
89	15:3948	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000772	MF-414
DOE/ER/40193–					
T3	15:3949	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003368	MF-414
DOE/ER/40224–					
108	15:3981	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003353	MF-414
110	15:3982	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003332	MF-414
114	15:3983	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003320	MF-414
115	15:4017	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003323	MF-414
129	15:3331	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003331	MF-414
85	15:3945	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003326	MF-414
86	15:3319	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003325	MF-414
87	15:3330	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003324	MF-414
90	15:3979	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003327	MF-413
91	15:3980	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003328	MF-414
DOE/ER/40266–					
2	15:3286	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002769	MF-411
DOE/ER/40273–					
4	15:4033	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002539	MF-413
DOE/ER/40281–					
4	15:4108	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002115	MF-414
DOE/ER/40389–					
54	15:3984	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002563	MF-414
56	15:4083	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002568	MF-413
57	15:3332	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002567	MF-414
61	15:3950	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002566	MF-414
62	15:3951	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002565	MF-414
DOE/ER/40405–					
T2	15:4064	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002875	MF-413

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/40416–					
2	15:3952	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003182	MF-413
DOE/ER/40417–					
4	15:4125	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002545	MF-413
DOE/ER/40427–					
09-N9	15:4126	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003337	MF-413
11-N9	15:3985	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003336	MF-414
12-N9	15:4127	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003335	MF-413
13-N9	15:4018	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003350	MF-414
14-N9	15:4019	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003349	MF-413
20-N9	15:4128	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003348	MF-414
DOE/ER/45182–					
5	15:2829	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002163	MF-404
DOE/ER/45199–					
T2	15:4212	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002524	MF-411
DOE/ER/53192–					
40	15:4399	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002543	MF-421
DOE/ER/53223–					
118	15:4305	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002955	MF-420
T2	15:4306	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003376	MF-420
DOE/ER/53263–					
7	15:4307	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002343	MF-421
DOE/ER/60015–					
7	15:3760	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002880	MF-408
DOE/ER/60294–					
T1	15:3410	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002755	MF-402
DOE/ER/60301–					
10	15:3539	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002704	MF-408
DOE/ER/60313–					
4	15:3411	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003351	MF-401
DOE/ER/60431–					
3	15:3545	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003045	MF-404
DOE/ER/60549–					
3	15:3412	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002553	MF-407
4	15:3413	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002554	MF-407
DOE/ER/60555–					
3	15:3817	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002970	MF-403
DOE/ER/60561–					
T1	15:3616	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003375	MF-408
DOE/ER/60588–					
3	15:3761	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002541	MF-408
DOE/ER/60631–					
2	15:3694	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001465	PC-408; PC-408
T4	15:3695	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001464	PC-408; PC-408
DOE/ER/60634–					
1	15:3617	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002692	MF-408
DOE/ER/60647–					
2	15:3818	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002540	MF-403
DOE/ER/60655–					
2	15:3414	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003314	MF-408
DOE/ER/60692–					
2	15:3603	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002542	MF-408
DOE/ET/53088–					
370	15:4308	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89016618	MF-427
401	15:4309	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003318	MF-420
407	15:4310	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003319	MF-420
DOE/FE–					
0141	15:2102	NTIS, PC A12/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001792	PC-101
DOE/FE/60850–					
T1	15:2077	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002555	MF-113
DOE/HWP–					
94	15:2673	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002910	MF-721
DOE/ID–					
10216-Vol.6	15:2515	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002006	MF-523
10219	15:2790	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002023	MF-331
10233(88)	15:2186	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002005	MF-510
10243	15:2576	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002049	MF-331
10252	15:2791	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002218	MF-333

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/IG–					
0273	15:4537	OSTI		TI90001806	PC-960
DOE/LC/11066–					
2719-Vol.1	15:2155	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011684	PC-123; PC-123
DOE/LC/11075–					
2737	15:2156	NTIS, PC A17/MF A01 - OSTI		DE89011701	PC-123; PC-123
DOE/MA–					
0384	15:4489	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002690	MF-900
DOE/MA/19117–					
T1	15:4490	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003092	MF-900
DOE/MC/22123–					
2735-Vol.1	15:2798	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011695	PC-111; PC-111
2735-Vol.2	15:2799	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011696	PC-111; PC-111
DOE/MC/23140–					
2695	15:2138	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000979	PC-132; PC-132
DOE/MC/25009–					
2752	15:2657	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002826	MF-110
DOE/MC/25151–					
2745	15:2095	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000401	MF-106
DOE/METC–					
89/6103	15:2142	NTIS, PC A20/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011683	MF-132
DOE/NASA–					
0352-3	15:2783	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002640	PC-332
DOE/NE–					
0098	15:2187	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001779	MF-512
DOE/OR/21400–					
T401	15:2830	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002720	
DOE/OR/21548–					
045-Rev.0	15:2242	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002280	MF-511
DOE/PC/30021–					
T20	15:2261	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002792	MF-108
T21	15:2262	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002793	MF-108
T22	15:2263	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002794	MF-108
DOE/PC/79680–					
T2	15:2648	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001224	PC-112; PC-112
DOE/PC/79796–					
T7	15:2422	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002869	MF-105
DOE/PC/79902–					
T1	15:2096	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000641	PC-104; PC-104
DOE/PC/79906–					
T2	15:2097	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002870	MF-115
DOE/PC/79921–					
T6	15:2067	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001946	MF-106
DOE/PC/79926–					
6	15:2019	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002764	MF-108
7	15:2020	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002765	MF-108
DOE/PC/79933–					
8	15:2021	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001694	MF-108
DOE/PC/88561–					
T1	15:2014	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002300	PC-102; PC-102
DOE/PC/88812–					
T5	15:2022	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003373	MF-108
DOE/PC/88813–					
T4	15:2023	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003372	MF-108
DOE/PC/88868–					
T3	15:2423	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001947	MF-105
DOE/PC/88874–					
T6	15:2424	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002757	MF-105
DOE/PC/88877–					
T3	15:2015	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001945	MF-102
DOE/PC/88881–					
T4	15:2016	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003374	MF-102

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/PC/88886–					
T4	15:2017	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003036	MF-102
DOE/PC/88900–					
5	15:2098	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003043	MF-113
DOE/PC/88917–					
T2	15:2024	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003371	MF-102
DOE/PC/88922–					
4	15:2055	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002766	MF-102
DOE/PC/88934–					
T3	15:2056	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003039	MF-102
DOE/PC/88935–					
T3	15:2025	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002761	MF-108
DOE/PC/88939–					
5	15:2083	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002801	MF-116
DOE/PC/88941–					
T4	15:2057	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002759	MF-102
DOE/PC/88947–					
T4	15:2084	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003370	MF-115
DOE/PC/89904–					
T4	15:2058	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003310	MF-105
DOE/PC/90014–					
T2	15:2264	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003033	MF-108
T3	15:2265	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003032	MF-108
DOE/PC/90274–					
T6	15:2649	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002868	MF-112
DOE/PC/90519–					
T11	15:2059	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002791	PC-102; PC-102
DOE/PC/90521–					
T12	15:2060	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003322	MF-113
DOE/PC/90527–					
T8	15:2061	NTIS, PC A04/MF A01 - OSTI		DE90002400	PC-102; PC-102
DOE/PC/90910–					
T1	15:2026	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001460	PC-108; PC-108
DOE/PC/91101–					
T8	15:2068	NTIS, PC A03/MF A01 - OSTI		DE90001400	PC-105; PC-105
DOE/PE–					
0092	15:2644	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002648	MF-920
0093	15:2618	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002625	PC-330
DOE/RW–					
0245	15:2188	OSTI		TI90002689	MF-840
DOE/SF/00098–					
T14	15:2109	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000771	PC-122
DOE/SF/16306–					
18	15:2332	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002536	MF-231
DOE/SR/14069–					
2	15:3492	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001936	MF-702
DOE/WIPP–					
89-007	15:2189	NTIS, PC A05/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002490	MF-810
89-009-Vol.1	15:2190	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002492	MF-810
89-009-Vol.2	15:2191	NTIS, PC A21/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002493	MF-810
89-014	15:2192	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002491	MF-810
DPC–					
90003257	15:4538	Database Promotion Center, Japan, 7th Fl. World Trade Center Bldg., 2-4-1, Hamamatsu-cho, Minato-ku, Tokyo, 105 Japan			
90003258	15:4539	Database Promotion Center, Japan, 7th fl. World Trade Center Bldg. 2-4-1, Hamamatsu-cho Minato-ku, Tokyo, 105 Japan			
DTH-LV–					
87-11	15:2345	NTIS (US Sales Only), PC A03/MF A01		DE90719270	
88-18	15:2352	NTIS (US Sales Only), PC A03		DE90718971	
DTH-LV-MEDD–					
197	15:2674	NTIS (US Sales Only), PC A08		DE90718990	
Digest–					
339	15:2679	*See* GB–206			
E–					
3745	15:3236	*See* N–89-17298			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
4855	15:3248	*See* N–89-28030			
4856	15:2296	*See* N–89-27705			
4865	15:2292	*See* N–89-27623			
4866	15:2295	*See* N–89-27619			
4888	15:2976	*See* N–89-27795			
4903	15:2928	*See* N–89-27038			
4941	15:3206	*See* N–89-27115			
4964	15:2975	*See* N–89-27223			
4980	15:2929	*See* N–89-27836			
5025	15:2780	*See* N–89-27700			
5041	15:2974	*See* N–89-26989			
5043	15:2416	*See* N–89-27702			
ECN–					
220	15:2099			DE90722329	
222	15:2100			DE90722330	
ECN-PB–					
89-4	15:2333			DE90722428	
ECTB–					
123-05B	15:2050	*See* PB–89-220966/XAB			
171-11B	15:3456	*See* PB–89-227847/XAB			
EEO-ED–					
241/224	15:2726			DE90718808	
EGG–					
2548	15:2542	*See* NUREG/CR–5225			
EGG-EAST–					
8546	15:2516	NTIS, PC A17/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002074	MF-506; MF-523
EGG-EP–					
8581	15:2658	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002090	MF-331
8708	15:2354	NTIS, PC A04/MF A01 - OSTI		DE90002028	MF-256
EGG-HFRU–					
8654	15:3126	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002231	
EGG-M–					
32787	15:2517	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001999	MF-523
34487	15:2485	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002017	MF-523
36387	15:2727	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002082	MF-310
36587	15:4404	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002081	MF-506
36787	15:2518	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002003	MF-523
37087	15:2831	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002078	MF-504
38887	15:3937	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001998	MF-363
88115	15:2577	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002016	MF-331
88154	15:2486	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002009	MF-523
88156	15:2519	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001995	MF-523
88163	15:2520	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002044	MF-523
88181	15:2193	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002092	MF-510
88260	15:4405	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002094	MF-425
88261	15:2062	NTIS, PC A02/MF A01 - OSTI		DE90002146	MF-501
88264	15:2357	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002012	MF-250
88268	15:4406	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002053	MF-425
88270	15:2490	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002010	MF-523; MF-527
88271	15:3127	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002055	MF-506; MF-520
88275	15:2521	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002013	MF-523
88277	15:4514	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002001	MF-506
88288	15:2480	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002091	MF-520
88300	15:2522	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002075	
88357	15:2832	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002086	MF-501; MF-506
88376	15:3546	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002073	MF-249
88428	15:2523	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002031	MF-523
88438	15:2524	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002032	MF-523
88469	15:2063	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002027	MF-102
88477	15:3609	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002004	MF-501
88501	15:2833	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002046	MF-404
89101	15:2277	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001749	MF-225
89119	15:2915	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002021	MF-506
89153	15:2916	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002058	MF-504
89182	15:3807	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002029	MF-502
89186	15:2438	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002068	MF-523
89193	15:3808	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002047	MF-502

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89209	15:2834	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002020	MF-404
89258	15:2792	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002085	MF-333
89302	15:2194	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002076	MF-513
89322	15:2728	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002042	MF-311
89361	15:2793	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002007	MF-331
89380	15:4515	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002045	MF-515
89437	15:4540	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002030	MF-505
EMR-SFA–					
83	15:2027	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth Street, Ottawa, Ontario, Canada K1A OG1			
EPA–					
520/1-89/009	15:3487	*See* PB–89-224273/XAB			
520/5-88-018	15:3568	NTIS, PC A03/MF A01; OSTI; US Environmental Protection Agency Office of Radiation Programs, 401 M Street, SW, Washington, DC 20460		DE89014543	
520/5-88/016	15:3571	*See* PB–89-210629/XAB			
520/5-89/013	15:3486	*See* PB–89-224000/XAB			
530/SW-89/048A	15:2764	*See* PB–89-221410/XAB			
530/SW-89/048B	15:2765	*See* PB–89-221428/XAB			
530/SW-89/048C	15:3518	*See* PB–89-221436/XAB			
530/SW-89/048D	15:3519	*See* PB–89-221535/XAB			
530/SW-89/048E	15:3520	*See* PB–89-221543/XAB			
530/SW-89/048O	15:2774	*See* PB–89-221527/XAB			
540/8-89/006	15:3590	*See* PB–89-235212/XAB			
600/3-88/035	15:3550	*See* PB–89-207005/XAB			
600/3-88/036	15:3549	*See* PB–89-205611/XAB			
600/9-89/064	15:3588	*See* PB–89-229975/XAB			
600/D-89/004	15:3766	*See* PB–89-218275/XAB			
600/D-89/005	15:3767	*See* PB–89-218804/XAB			
600/D-89/007	15:3768	*See* PB–89-218812/XAB			
600/D-89/010	15:3431	*See* PB–89-218788/XAB			
600/D-89/014	15:3578	*See* PB–89-218770/XAB			
600/D-89/025	15:3249	*See* PB–89-218242/XAB			
600/D-89/031	15:2775	*See* PB–89-223903/XAB			
600/D-89/033	15:3779	*See* PB–89-223952/XAB			
600/D-89/036	15:3449	*See* PB–89-223721/XAB			
600/D-89/037	15:3556	*See* PB–89-222624/XAB			
600/D-89/043	15:2763	*See* PB–89-221360/XAB			
600/D-89/054	15:3438	*See* PB–89-221253/XAB			
600/D-89/055	15:3437	*See* PB–89-221246/XAB			
600/D-89/056	15:3256	*See* PB–89-222681/XAB			
600/D-89/060	15:3777	*See* PB–89-223630/XAB			
600/D-89/061	15:3612	*See* PB–89-223622/XAB			
600/D-89/062	15:3776	*See* PB–89-223606/XAB			
600/D-89/068	15:3440	*See* PB–89-221279/XAB			
600/D-89/069	15:3772	*See* PB–89-222673/XAB			
600/D-89/070	15:3773	*See* PB–89-222707/XAB			
600/D-89/079	15:3439	*See* PB–89-221261/XAB			
600/D-89/081	15:2743	*See* PB–89-223663/XAB			
600/D-89/085	15:2742	*See* PB–89-222814/XAB			
600/D-89/087	15:3775	*See* PB–89-222830/XAB			
600/D-89/088	15:3450	*See* PB–89-223960/XAB			
600/D-89/089	15:3778	*See* PB–89-223804/XAB			
600/D-89/092	15:3780	*See* PB–89-223986/XAB			
600/D-89/093	15:3774	*See* PB–89-222798/XAB			
600/D-89/096	15:3234	*See* PB–89-222806/XAB			
600/D-89/097	15:3783	*See* PB–89-224588/XAB			
600/D-89/098	15:3784	*See* PB–89-224596/XAB			
600/D-89/102	15:3781	*See* PB–89-224554/XAB			
600/J-89/004	15:2595	*See* PB–89-236418/XAB			
625/5-88/024	15:3484	*See* PB–89-205975/XAB			
901/5-89/001	15:3582	*See* PB–89-220974/XAB			
EPA/AA/TEB–					
89/02	15:2797	*See* PB–89-230106/XAB			
EPA/ROD/R–					
01-88/031	15:3527	*See* PB–89-225577/XAB			
02-88/074	15:3579	*See* PB–89-219224/XAB			
02-89/076	15:3530	*See* PB–89-229546/XAB			
02-89/077	15:3591	*See* PB–89-235279/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EPA/ROD/R–					
03-88/045	15:3589	*See* PB–89-233894/XAB			
03-88/068	15:3525	*See* PB–89-225536/XAB			
03-89/065	15:3535	*See* PB–89-229595/XAB			
03-89/066	15:3586	*See* PB–89-229512/XAB			
03-89/067	15:3534	*See* PB–89-229587/XAB			
04-89/043	15:3533	*See* PB–89-229579/XAB			
05-88/062	15:3584	*See* PB–89-225486/XAB			
05-88/068	15:3528	*See* PB–89-225908/XAB			
05-88/069	15:3522	*See* PB–89-225494/XAB			
05-88/079	15:3523	*See* PB–89-225510/XAB			
05-89/086	15:3587	*See* PB–89-229520/XAB			
06-88/037	15:3524	*See* PB–89-225528/XAB			
06-89/047	15:3532	*See* PB–89-229561/XAB			
07-89/022	15:3531	*See* PB–89-229553/XAB			
07-89/023	15:3500	*See* PB–89-229538/XAB			
08-89/022	15:3529	*See* PB–89-229504/XAB			
10-88/011	15:3526	*See* PB–89-225544/XAB			
EPRI-CS–					
5588-Vol.3	15:2410	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-CU–					
6546	15:2645	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6561-Vol.1	15:2564	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6561-Vol.2	15:2565	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-EL–					
6483	15:2411	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-EN–					
6518-Vol.2	15:2425	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-GS–					
5949	15:2412	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6253	15:2413	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6540	15:2069	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6544	15:2414	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6563	15:2258	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6569-Vol.1	15:2070	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6569-Vol.2	15:2071	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6574	15:2415	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6578	15:2078	Research Reports Center, Box 50490, Palo Alto, CA 94303			
EPRI-NP–					
4574-CCM-Pt.2-Ch.5-Vol.1	15:2525	Research Reports Center, Box 50490, Palo Alto, CA 94303			
5673	15:2195	Research Reports Center, Box 50490, Palo Alto, CA 94303			
5708-Vol.1-Rev.1	15:2443	Research Reports Center, Box 50490, Palo Alto, CA 94303			
5708-Vol.2	15:2444	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6480-Vol.4	15:2547	*See* NUREG/CR–5395-Vol.4			
6480-Vol.6	15:2548	*See* NUREG/CR–5395-Vol.6			
6480-Vol.7	15:2549	*See* NUREG/CR–5395-Vol.7			
6480-Vol.8	15:2550	*See* NUREG/CR–5395-Vol.8			
6496	15:2526	Research Reports Center, Box 50490, Palo Alto, CA 94303			
6528	15:2445	Research Reports Center, Box 50490, Palo Alto, CA 94303			
ERL–					
290666-1	15:2648	*See* DOE/PC/79680–T2			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ESG–					
78	15:3265	*See* LBL–27649			
ETDE-mf–					
0717862	15:2291	NTIS (US Sales Only), PC A03/MF A01		DE90717862	
0717865	15:2426	NTIS (US Sales Only), PC A06/MF A01		DE90717865	
0717888	15:2800	NTIS (US Sales Only), PC A07/MF A01		DE90717888	
0717889	15:2427	NTIS (US Sales Only), PC A03/MF A01		DE90717889	
0717911	15:2359	NTIS (US Sales Only), PC A03/MF A01		DE90717911	
0717917	15:2785	NTIS (US Sales Only), PC A05/MF A01		DE90717917	
0717921	15:2729	NTIS (US Sales Only), PC A04/MF A01		DE90717921	
0717924	15:2028	NTIS (US Sales Only), PC A06/MF A01		DE90717924	
0718061	15:3762	NTIS (US Sales Only), PC A03/MF A01		DE90718061	
0718075	15:3235	NTIS (US Sales Only), PC A05/MF A01		DE90718075	
0718079	15:2675	NTIS (US Sales Only), PC A06/MF A01		DE90718079	
0718080	15:2110	NTIS (US Sales Only), PC A05/MF A01		DE90718080	
0718167	15:2085	NTIS (US Sales Only), PC A06/MF A01		DE90718167	
0718193	15:2086	NTIS (US Sales Only), PC A06/MF A01		DE90718193	
0718199	15:2676	NTIS (US Sales Only), PC A09/MF A01		DE90718199	
0721837	15:2029	NTIS (US Sales Only), PC A06/MF A01		DE90721837	
0721861	15:2346	NTIS (US Sales Only), PC A06/MF A01		DE90721861	
0721863	15:2072	NTIS (US Sales Only), PC A10/MF A01		DE90721863	
0721936	15:2270	NTIS (US Sales Only), PC A03/MF A01		DE90721936	
0721937	15:2730	NTIS (US Sales Only), PC A07/MF A01		DE90721937	
0721946	15:2760	NTIS (US Sales Only), PC A13/MF A01		DE90721946	
0722093	15:2103	NTIS (US Sales Only), PC A04/MF A01		DE90722093	
0722258	15:2293	NTIS (US Sales Only), PC A04/MF A01		DE90722258	
0722264	15:2731	NTIS (US Sales Only), PC A07/MF A01		DE90722264	
0722300	15:2590	NTIS (US Sales Only), PC A04/MF A01		DE90722300	
0722301	15:2104	NTIS (US Sales Only), PC A06/MF A01		DE90722301	
0722342	15:2677			DE90722342	
0722344	15:2678			DE90722344	
ETEC–					
89-7	15:2710	*See* NASA-CR–185163			
ETSU-GEN–					
2006-P2	15:2647	NTIS (US Sales Only), PC A05		DE90722761	
ETSU-R–					
48	15:2732	NTIS (US Sales Only), PC A05		DE90722715	
ETSU-SSH–					
4063-P1	15:2276	NTIS (US Sales Only), PC A08		DE90722760	
ETSU-WN–					
5063	15:2362	NTIS (US Sales Only), PC A07/MF A01		DE90722758	
5098	15:2363	NTIS (US Sales Only), PC A06/MF A01		DE90722759	
EUR–					
11776	15:2196	NTIS (US Sales Only), PC A99/MF A01			
11777	15:2197	NTIS (US Sales Only), PC A99/MF A01			
11778	15:2198	NTIS (US Sales Only), PC A99/MF A01			
11779	15:2199	NTIS (US Sales Only), PC A99/MF A01			
FERMILAB-PUB–					
89/128-A-PAPER-1	15:3849	*See* N–89-27608			
FFAP-A–					
778	15:2386	*See* STEV-VIND–89-17			
FISH/WILDLIFE-LEAFLT–					
13.2.2	15:2601	*See* PB–89-224984/XAB			
FISH/WILDLIFE-TR–					
21	15:2602	*See* PB–89-224992/XAB			
FJSRL-JR–					
87-0012	15:4202	*See* AD-A–211124/3/XAB			
FNAL-TM–					
1620	15:3333	NTIS, PC A05/MF A01; OSTI; INIS		DE90001797	PC-414
1622	15:3619	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001875	PC-414
1623	15:3287	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003184	PC-414
1626	15:3288	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003183	PC-414
FNAL/C–					
89/163-T	15:4034	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002110	MF-414
89/172	15:4516	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002916	MF-405
89/194	15:4491	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001574	MF-400
89/207-E	15:3953	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002186	MF-414
89/232-T	15:3986	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003345	MF-414
FRCEA-TH–					
189	15:4311	NTIS (US Sales Only), PC A10/MF A01		DE90721234	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
FRNC-TH–					
3474	15:3188	NTIS (US Sales Only), PC A14/MF A01		DE90721102	
FSGTR-NC–					
127	15:2298	*See* PB–89-226799/XAB			
FSRB-NC–					
110	15:3455	*See* PB–89-226856/XAB			
FSRP-NE–					
624	15:2273	*See* PB–89-230510/XAB			
FSRP-PNW–					
409	15:2299	*See* PB–89-230189/XAB			
FSW/OMA–					
89/01	15:3613	*See* PB–89-232755/XAB			
FTD-ID(RS)T–					
1133-88	15:3799	*See* AD-A–210698/7/XAB			
GA-A–					
19739	15:4407	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003292	MF-420
19740	15:4408	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003364	MF-422
19741	15:4409	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003291	MF-420; MF-405
19742	15:4410	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003343	MF-420
19747	15:4411	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003290	MF-420
19748	15:4412	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003289	MF-420; MF-405
19751	15:4413	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003288	MF-420
19752	15:4414	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003287	MF-420
19756	15:4415	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002914	MF-421
19800	15:2899	*See* AD-A–211070/8/XAB			
19860	15:4312	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002915	MF-420
GAMI–					
90003256	15:2917	Gorham Advanced Materials Institute, P.O. Box 250, Gorham, Maine 04038			
GAO/RCED–					
89-18	15:3320	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
89-38	15:3547	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
GB–					
206	15:2679	NTIS (US Sales Only), PC A02		DE90722716	
GKSS–					
89/E/13	15:2465	Reprint from ASTM STP 1011, L.E. Steele (ed.), American Society for Testing and Materials, Philadelphia, 1989, p. 115-129			
89/E/16	15:2835	Reprint from Nucl. Eng. Des. (Mar 1989) v. 112 p. 155-164			
GL-TR–					
89-0164	15:3881	*See* AD-A–210337/2/XAB			
GNT–					
02/80	15:2441	*See* CNEN-DR–88/80/A			
GRI–					
89/0150	15:2136	*See* PB–89-232599/XAB			
GSF–					
26/88	15:3540	NTIS (US Sales Only), PC A07/MF A01		DE90717914	
HETA–					
87-109-1950	15:3458	*See* PB–89-230247/XAB			
88-224-1951	15:3457	*See* PB–89-228720/XAB			
88-372-1953	15:3459	*See* PB–89-230254/XAB			
HHS/PUB/FDA–					
89-8031	15:3679	*See* PB–89-221139/XAB			
HIFAN–					
431	15:4438	*See* LBL–27230			
HW–					
32809	15:3548	NTIS, PC A02/MF A01 - OSTI	E 1.99:	DE90002517	MF-603
33128	15:3503	NTIS, PC A03/MF A01 - OSTI		DE90002518	MF-600
34461	15:2527	NTIS, PC A03/MF A01 - OSTI		DE90002520	MF-520
39558	15:3504	NTIS, PC A03/MF A01 - OSTI	E 1.99:	DE90002521	MF-600
IAEA-INFCIRC–					
2(Rev.37)	15:4492	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608889	
369	15:2245	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608880	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
IAEA-R–					
3948-F	15:3620	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90608415	
IAEA-SM–					
296/80	15:2517	*See* EGG-M–32787			
310/63P	15:2528	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002483	MF-523
IAEA-TECDOC–					
507	15:2434	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90608683	
IAERU–					
8802	15:4486	NTIS (US Sales Only), PC A07/MF A01		DE90705939	
IBP-WB–					
11/87	15:2680	NTIS (US Sales Only), PC A03/MF A01		DE90718064	
IC–					
89/101	15:4213	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607231	
89/102	15:4214	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607232	
89/110	15:4264	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606947	
89/111	15:4265	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606948	
89/115	15:4035	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607091	
89/121	15:4215	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607259	
89/122	15:4313	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607452	
89/126	15:4266	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606949	
89/130	15:4267	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606950	
89/131	15:4314	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607469	
89/132	15:4216	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607260	
89/133	15:4129	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607666	
89/137	15:3954	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607644	
89/140	15:4268	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606951	
89/141	15:3988	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607607	
89/145	15:4036	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607092	
89/147	15:2918	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608043	
89/152	15:4315	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607470	
89/156	15:4217	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607233	
89/157	15:4269	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606952	
89/158	15:4270	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607043	
89/159	15:4218	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607261	
89/160	15:4037	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607093	
89/162	15:4271	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607044	
89/167	15:4272	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607045	
89/168	15:4038	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607094	
89/170	15:3262	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608630	
89/171	15:4273	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606953	
89/172	15:4316	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607471	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89/173	15:4039	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607095	
89/177	15:4274	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606954	
89/178	15:3989	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607608	
89/179	15:4040	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607096	
89/182	15:4130	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607715	
89/183	15:4275	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606955	
89/185	15:4276	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607062	
89/187	15:4131	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607716	
89/192	15:4277	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606956	
89/195	15:4278	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606957	
89/196	15:3990	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607635	
89/197	15:4219	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607234	
89/202	15:4132	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607667	
89/206	15:4279	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90606958	
89/209	15:4133	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607755	
89/211	15:3888	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607151	
89/215	15:4280	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606959	
89/216	15:4281	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606960	
89/217	15:4282	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90606961	
89/239	15:4220	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607235	
89/258	15:4041	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607097	
89/50	15:3809	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608161	
89/51	15:3810	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608162	
89/63	15:3569	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608173	
89/74	15:3987	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607636	
89/80	15:4263	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607046	
ICOMP–					
89-16	15:3206	*See* N–89-27115			
IEN-DQUI-DIQUI-NT–					
01/80	15:3043	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607886	
IFSR–					
370	15:4308	*See* DOE/ET/53088–370			
401	15:4309	*See* DOE/ET/53088–401			
407-Review	15:4310	*See* DOE/ET/53088–407			
IITRI-E–					
06595-5	15:3795	*See* AD-A–210200/2/XAB			
IKE–					
7-9	15:2681	NTIS (US Sales Only), PC A07/MF A01		DE90718198	
INDC(CCP)–					
301/GF	15:4416	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607489	
302/L	15:4112	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90607803	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
INDC(JPN)–					
128/L	15:4157	*See* JAERI-M–89-129			
129/L	15:4119	*See* JAERI-M–89-143			
130/L	15:4427	*See* JAERI-M–89-167			
INDC(NDS)–					
220	15:4134	NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS		DE90607759	
224/GF	15:4179	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607655	
INDC-EUR–					
022-G	15:4193	*See* NEANDC-E–292-U-Vol.III-Euratom			
INFN-LNF–					
89/042(PT)	15:4042	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607096	
INIS-BR–					
1627	15:3044	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607848	
1672	15:2167	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607956	
1683	15:4180	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90607662	
1685	15:3334	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90608804	
1686	15:3189	NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS		DE90608607	
1688	15:4186	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608341	
1689	15:2836	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607970	
1691	15:3190	NTIS (US Sales Only), PC A19/MF A01 - OSTI; INIS		DE90608608	
1695	15:2475	NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS		DE90608656	
1698	15:3076	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90607262	
1699	15:3045	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90607887	
1700	15:3046	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90607849	
1701	15:3047	NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS		DE90607877	
1702	15:4221	NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS		DE90607263	
1703	15:2160	NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS		DE90608131	
1706	15:3991	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607581	
1710	15:2168	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607957	
1713	15:2446	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608701	
1714	15:2447	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608702	
1715	15:2448	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608703	
1717	15:4222	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607264	
1718	15:2123	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608333	
1719	15:4187	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608344	
1720	15:4188	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608334	
1721	15:2172	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608621	
1722	15:3048	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607850	
1723	15:3049	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607888	
1724	15:2161	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607889	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
1725	15:3050	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607890	
1726	15:3051	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607878	
1727	15:3103	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607851	
1728	15:3052	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607891	
1729	15:2162	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607892	
1730	15:2169	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607879	
1731	15:3053	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607880	
1732	15:3054	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607881	
1733	15:2529	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90608315	
1734	15:3621	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608416	
1735	15:3686	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608255	
1736	15:3104	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607940	
1737	15:3622	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608417	
1738	15:3623	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608418	
1740	15:3696	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608198	
1741	15:3697	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608313	
1743	15:2614	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608868	
1744	15:2487	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608322	
1745	15:4493	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608891	
1747	15:4189	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608345	
1748	15:3335	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608788	
1749	15:3336	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608789	
1750	15:3337	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608812	
1754	15:3055	NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS		DE90607852	
1755	15:4223	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE90607267	
1759	15:3698	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608314	
1760	15:3056	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90607853	
1762	15:4224	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607268	
1764	15:4084	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90607783	
1765	15:2837	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90607994	
1766	15:2971	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90608107	
1767	15:4225	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90607269	
1768	15:3057	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90607854	
1769	15:4226	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE90607270	
1770	15:3058	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90607893	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
INIS-SU–					
114	15:3625	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90705937	
INIS-mf–					
11543(No.1)	15:3687	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608276	
11557	15:3505	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90608113	
11558	15:4190	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608346	
11562	15:4191	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90608347	
12007	15:3992	NTIS (US Sales Only), PC A03/MF A01		DE90718756	
12011	15:2435	NTIS (US Sales Only), PC A10/MF A01		DE90722065	
12012	15:3699	NTIS (US Sales Only), PC A05/MF A01		DE90722496	
12013	15:4065	NTIS (US Sales Only), PC A10/MF A01		DE90722124	
12015	15:3624	NTIS (US Sales Only), PC A06/MF A01		DE90722246	
12016	15:2530	NTIS (US Sales Only), PC A03/MF A01		DE90722260	
12017	15:2531	NTIS (US Sales Only), PC A04/MF A01		DE90722261	
12018	15:2200	NTIS (US Sales Only), PC A09/MF A01		DE90721986	
12019	15:2532	NTIS (US Sales Only), PC A05/MF A01		DE90722431	
12020	15:2919	NTIS (US Sales Only), PC A03/MF A01		DE90722241	
4754(no.39)	15:4317	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90607372	
INS–					
744	15:3296	NTIS (US Sales Only), PC A02/MF A01		DE90719505	
745	15:4152	NTIS (US Sales Only), PC A03/MF A01		DE90719506	
746	15:3827	NTIS (US Sales Only), PC A03/MF A01		DE90719507	
747	15:3957	NTIS (US Sales Only), PC A02/MF A01		DE90719711	
748	15:4153	NTIS (US Sales Only), PC A03/MF A01		DE90719508	
749	15:4154	NTIS (US Sales Only), PC A03/MF A01		DE90719509	
750	15:4043	NTIS (US Sales Only), PC A03/MF A01		DE90719558	
751	15:4155	NTIS (US Sales Only), PC A03/MF A01		DE90719557	
752	15:3958	NTIS (US Sales Only), PC A03/MF A01		DE90719559	
754	15:4020	NTIS (US Sales Only), PC A03/MF A01		DE90719575	
755	15:4021	NTIS (US Sales Only), PC A03/MF A01		DE90719576	
756	15:4022	NTIS (US Sales Only), PC A03/MF A01		DE90719578	
757	15:4002	NTIS (US Sales Only), PC A03/MF A01		DE90719577	
INSRP–					
89-01-Vol.1	15:2650	*See* UCID–21775-Vol.1			
89-01-Vol.2	15:2651	*See* UCID–21775-Vol.2			
IPEN-PUB–					
219	15:4494	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608892	
IPNO-TH–					
88-61	15:4003	NTIS (US Sales Only), PC A03/MF A01		DE90721242	
IPPJ-DT–					
146	15:3476	NTIS (US Sales Only), PC A06/MF A01		DE90719715	
147	15:3477	NTIS (US Sales Only), PC A04/MF A01		DE90719714	
152	15:4318	NTIS (US Sales Only), PC A03/MF A01		DE90719543	
IPPJ-REV–					
4	15:4319	NTIS (US Sales Only), PC A06/MF A01		DE90705940	
IPPJ-T–					
38	15:4419	NTIS (US Sales Only), PC A14/MF A01		DE90719705	
ITP-SB–					
89-56	15:4034	*See* FNAL/C–89/163-T			
IVL-B–					
912	15:3478	NTIS (US Sales Only), PC A03/MF A01		DE90719421	
IWS–					
078.23	15:3433	*See* PB–89-221030/XAB			
078.28	15:3434	*See* PB–89-221055/XAB			
JAERI–					
1318	15:2453	NTIS (US Sales Only), PC A03/MF A01		DE90719604	
JAERI-M–					
89-018	15:4420	NTIS (US Sales Only), PC A03/MF A01		DE90719529	
89-060	15:2461	NTIS (US Sales Only), PC A03/MF A01		DE90719473	
89-061	15:4339	NTIS (US Sales Only), PC A04/MF A01		DE90719544	
89-063	15:2838	NTIS (US Sales Only), PC A03/MF A01		DE90719511	
89-064	15:2454	NTIS (US Sales Only), PC A05/MF A01		DE90719510	
89-066	15:3323	NTIS (US Sales Only), PC A03/MF A01		DE90719531	
89-069	15:2462	NTIS (US Sales Only), PC A10/MF A01		DE90719530	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-070	15:2439	NTIS (US Sales Only), PC A05/MF A01		DE90719541	
89-071	15:4230	NTIS (US Sales Only), PC A05/MF A01		DE90719537	
89-074	15:4421	NTIS (US Sales Only), PC A06/MF A01		DE90719536	
89-075	15:4422	NTIS (US Sales Only), PC A03/MF A01		DE90719526	
89-076	15:2533	NTIS (US Sales Only), PC A03/MF A01		DE90719547	
89-077	15:2534	NTIS (US Sales Only), PC A04/MF A01		DE90719540	
89-078	15:2535	NTIS (US Sales Only), PC A03/MF A01		DE90719542	
89-079	15:3324	NTIS (US Sales Only), PC A03/MF A01		DE90719538	
89-080	15:2491	NTIS (US Sales Only), PC A03/MF A01		DE90719539	
89-081	15:4423	NTIS (US Sales Only), PC A03/MF A01		DE90719548	
89-082	15:3479	NTIS (US Sales Only), PC A03/MF A01		DE90719560	
89-084	15:4424	NTIS (US Sales Only), PC A04/MF A01		DE90719545	
89-085	15:2294	NTIS (US Sales Only), PC A08/MF A01		DE90719546	
89-086	15:4340	NTIS (US Sales Only), PC A03/MF A01		DE90719528	
89-087	15:4425	NTIS (US Sales Only), PC A03/MF A01		DE90719607	
89-088	15:4341	NTIS (US Sales Only), PC A03/MF A01		DE90719527	
89-090	15:4426	NTIS (US Sales Only), PC A03/MF A01		DE90719572	
89-091	15:2471	NTIS (US Sales Only), PC A03/MF A01		DE90719606	
89-093	15:4156	NTIS (US Sales Only), PC A03/MF A01		DE90719573	
89-094	15:2920	NTIS (US Sales Only), PC A03/MF A01		DE90719574	
89-096	15:2972	NTIS (US Sales Only), PC A03/MF A01		DE90719605	
89-129	15:4157	Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, 319-11, Japan			
89-143	15:4119	Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, 319-11, Japan			
89-167	15:4427	Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan			
JET-R–					
89-06	15:3480	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608185	
JINR-E–					
11-89-174	15:4518	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000719	
6-89-411	15:4158	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000717	
JPL-PUBL–					
88-28	15:3361	*See* N–89-28454			
JYFL-RR–					
1/1987	15:3325	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90608638	
1/1989	15:4004	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607609	
2/1987	15:2839	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608000	
3/1988	15:4106	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90607797	
Juel–					
2212	15:3062	NTIS (US Sales Only), PC A10/MF A01		DE90721938	
2250	15:3506	NTIS (US Sales Only), PC A06/MF A01		DE90721871	
Juel-Spez–					
488	15:2449	NTIS (US Sales Only), PC A11/MF A01		DE90722226	
493	15:3392	NTIS (US Sales Only), PC A06/MF A01		DE90721901	
K/ITP–					
111	15:2249	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002423	MF-515
KCP–					
613-4127	15:3063	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002967	MF-701
KEO-ANNUAL–					
2	15:3884	*See* AD-A–210792/8/XAB			
KFK–					
4447	15:3481	NTIS (US Sales Only), PC A07/MF A01		DE90722280	
4527	15:4519	NTIS (US Sales Only), PC A05/MF A01		DE90722072	
4622	15:3064	NTIS (US Sales Only), PC A07/MF A01		DE90722448	
KFK-PEF–					
51	15:3416	Available from Kernforschungszentrum Karlsruhe GmbH (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftreinhaltung (PEF)			
52	15:3763	NTIS (US Sales Only), PC A11/MF A01		DE90718175	
KRW–					
89-001	15:2047	*See* PB–89-232631/XAB			
KTM/E-D–					
172	15:2682	NTIS (US Sales Only), PC A04		DE90719328	
173	15:2683	NTIS (US Sales Only), PC A05/MF A01		DE90719324	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
174	15:2684	NTIS (US Sales Only), PC A04/MF A01		DE90719327	
KURRI-TR–					
315	15:4159	NTIS (US Sales Only), PC A06/MF A01		DE90719706	
LA–					
11474	15:3764	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002969	MF-708
11567-MS	15:3155	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001811	PC-701
11634-MS	15:4487	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002337	MF-700
11651-MS	15:3593	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002621	MF-700
11652-MS	15:3744	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002278	MF-721
11662-MS	15:3297	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001776	MF-405
11670-PR	15:3946	NTIS, PC A10/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001809	MF-410; MF-414
11685-T	15:4079	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002909	MF-410
11702-MS	15:3353	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002830	MF-700
LA-UR–					
89-1909	15:4428	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014027	MF-426
89-2000	15:3676	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002637	MF-900
89-3068	15:4429	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001836	MF-413
89-3174	15:4342	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002537	MF-424
89-3268	15:4430	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002354	MF-424
89-3275	15:4431	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002352	MF-400
89-3277	15:4432	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002350	MF-424
89-3289	15:4433	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002345	MF-420
89-3292	15:4434	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002447	MF-420
89-3297	15:4435	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002445	MF-420
89-3331	15:3128	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002440	MF-406
89-3334	15:4231	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002439	MF-910
89-3337	15:4285	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002437	MF-410
89-3342	15:4436	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002436	MF-420
89-3354	15:2201	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002433	MF-721
89-3355	15:2202	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002432	MF-721
89-3361	15:4232	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002431	MF-910
89-3380	15:4256	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002393	MF-406
89-3394	15:3156	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002389	MF-706
89-3395	15:3157	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002388	MF-706
89-3397	15:3298	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002387	
89-3406	15:3158	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002386	MF-706
89-3407	15:4437	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002385	MF-712
89-3410	15:2203	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002384	MF-711
89-3431	15:3482	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002382	MF-706
89-3438	15:3159	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002381	MF-706
89-3465	15:4286	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002380	MF-905
89-3498	15:3378	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002404	MF-700; MF-705
89-3503	15:2204	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002402	MF-802
89-3535	15:4073	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002398	MF-411
89-3537	15:4044	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002397	MF-910
89-3581	15:3160	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002412	
89-3600	15:3271	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002409	MF-414
89-3616	15:2921	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002408	MF-404; MF-406
89-3638	15:4160	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002656	MF-414
89-3695	15:3959	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003171	MF-910
89-3699	15:2246	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003170	MF-830
89-4011	15:2922	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003367	MF-332
LBL–					
20090	15:2685	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002606	PC-350
20332	15:2686	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002609	PC-350
20333	15:2687	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002608	PC-350
20645	15:2688	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002607	PC-350; PC-402; PC-407
21520	15:3299	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003046	MF-414
22642	15:2646	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002610	PC-350
24121	15:4541	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003118	MF-405
24805-Rev.	15:2205	NTIS, PC A02/MF A01; OSTI; INIS		DE90002449	MF-802
25337	15:4542	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003114	MF-405
25674-Rev.	15:2631	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003297	PC-400
25790	15:4233	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003121	MF-410
26248	15:3300	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003107	MF-414
26362	15:3811	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002617	MF-403

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
26490	15:4234	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003108	MF-411
26600	15:4543	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003117	MF-405
26612-Vol.1	15:2355	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003119	MF-403
26612-Vol.2	15:2356	NTIS, PC A19/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002528	MF-251
26703	15:2206	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003299	PC-815
26704	15:2207	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003294	PC-802
26780	15:2208	NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002614	PC-814
26796	15:4520	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003105	MF-405
26827	15:2209	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003079	MF-814
26828	15:2210	NTIS, PC A02/MF A01; OSTI; INIS		DE90003267	MF-814
26842	15:3301	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003106	MF-414
26843	15:3302	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003270	MF-411
26844	15:3303	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003271	MF-414
26906	15:3096	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002463	MF-401
27000	15:3259	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002618	PC-410
27001	15:3264	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003300	PC-414
27037	15:2578	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002604	MF-210
27131	15:2624	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002612	PC-350
27140	15:2689	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002603	MF-350
27225	15:2211	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003081	MF-814
27226	15:3498	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002602	
27230	15:4438	NTIS, PC A03/MF A01; OSTI; INIS		DE90003296	PC-411
27289	15:2622	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002605	PC-350
27339	15:3304	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000126	MF-413
27380	15:2840	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002332	MF-404
27421	15:3305	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002668	MF-426
27423	15:3891	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002453	
27429	15:2212	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002684	MF-402
27450	15:2635	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003298	PC-101
27452	15:4023	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002121	MF-413
27466	15:2579	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002600	MF-210
27534	15:2690	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003126	MF-350
27599	15:3960	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002452	MF-414
27606	15:3306	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002670	MF-414
27608	15:3277	*See* SLAC-PUB–5060			
27627	15:3129	NTIS, PC A03/MF A01 - OSTI		DE90002460	MF-406
27649	15:3265	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002461	MF-414
27657	15:2923	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002377	MF-404
27664	15:3307	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002166	MF-414
27680	15:4521	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001570	MF-406
27692	15:2691	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002456	MF-402
27729	15:2111	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003112	MF-122
27743	15:4439	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002450	MF-422
27746	15:3130	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002679	MF-406
27747	15:3828	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002682	MF-412
27748	15:2636	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002455	MF-350
27763	15:3266	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002451	MF-414
27765	15:3272	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002681	MF-414
27766	15:3273	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002678	MF-414
27778	15:3812	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002680	MF-810
27806	15:4235	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003265	MF-410
27813	15:3354	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002669	MF-414
27826	15:3131	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002328	MF-414
27833	15:4066	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002070	MF-413
27834	15:2841	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003113	MF-404
27846	15:2105	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003273	MF-900
27867	15:3802	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002454	MF-408
27874	15:4161	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003109	MF-413
27878	15:4120	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003274	MF-413
27881	15:4162	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003272	MF-414
27885	15:4067	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003127	MF-413
27894	15:4099	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003082	MF-414
27904	15:3108	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002462	MF-406
27916	15:3109	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003124	MF-401
27918	15:3745	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003116	MF-407
27919	15:3677	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003275	MF-407
27937	15:3077	NTIS, PC A; OSTI; INIS; GPO Dep.	E 1.99:	DE90003120	MF-411
27938	15:3078	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003122	MF-401
27940	15:3079	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003115	MF-401
LBL-PUB–					
630-Rev./10-89	15:2609	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002245	MF-400; MF-408

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
LC–					
88-25450	15:3867	*See* N–89-28474			
LHRL-LIB/Trans–					
3	15:4192	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89618065	
LIS–					
84	15:3803	Available from Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)			
LITH-IKP-R–					
507	15:2641	*See* SV–2000-352-2			
LNCC–					
009/89	15:3192	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608611	
010/89	15:3193	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608612	
011/89	15:3194	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608613	
LRC–					
89-7	15:4307	*See* DOE/ER/53263–7			
LiU-Tek-Lic–					
1989-04	15:3191	NTIS (US Sales Only), PC A03/MF A01		DE90719414	
1989-13	15:2637	NTIS (US Sales Only), PC A08/MF A01		DE90719413	
MF–					
119	15:4305	*See* DOE/ER/53223–118			
MHD-ITC–					
89-012	15:2649	*See* DOE/PC/90274–T6			
MIT/CS/TR–					
432	15:4497	*See* AD-A–207609/9/XAB			
MLM–					
3612(OP)	15:3380	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003028	MF-704
MMT–					
0	15:2099	*See* ECN–220			
1	15:2100	*See* ECN–222			
MS–					
7997	15:3143	*See* AD-A–210706/8/XAB			
8036	15:2898	*See* AD-A–210781/1/XAB			
8060	15:3147	*See* AD-A–210778/7/XAB			
8285	15:3148	*See* AD-A–210780/3/XAB			
MTL-TR–					
89-44	15:2967	*See* AD-A–211170/6/XAB			
89-51	15:2966	*See* AD-A–210825/6/XAB			
89-52	15:3212	*See* AD-A–211225/8/XAB			
89-63	15:2810	*See* AD-A–211166/4/XAB			
N–					
89-17298	15:3236	NTIS, PC A20/MF A01			
89-17364	15:3417	NTIS, PC A04/MF A01			
89-22981	15:2464	NTIS, PC A07/MF A01			
89-24538	15:3203	NTIS, PC A13/MF A01			
89-26918	15:2973	NTIS, PC A03/MF A01			
89-26989	15:2974	NTIS, PC A03/MF A01			
89-27038	15:2928	NTIS, PC A02/MF A01			
89-27115	15:3206	NTIS, PC A03/MF A01			
89-27223	15:2975	NTIS, PC A03/MF A01			
89-27256	15:2320	NTIS, PC A07/MF A01			
89-27477	15:4163	NTIS, PC A08/MF A01			
89-27608	15:3849	NTIS, PC A03/MF A01			
89-27619	15:2295	NTIS, PC A03/MF A01			
89-27623	15:2292	NTIS, PC A03/MF A01			
89-27629	15:3850	NTIS, PC A03/MF A01			
89-27700	15:2780	NTIS, PC A03/MF A01			
89-27702	15:2416	NTIS, PC A02/MF A01			
89-27705	15:2296	NTIS, PC A02/MF A01			
89-27795	15:2976	NTIS, PC A03/MF A01			
89-27836	15:2929	NTIS, PC A03/MF A01			
89-28030	15:3248	NTIS, PC A03/MF A01			
89-28035	15:2977	NTIS, PC A05/MF A01			
89-28454	15:3361	NTIS, PC A08/MF A01			
89-28471	15:3866	NTIS, PC A03/MF A01			
89-28474	15:3867	NTIS, PC A18/MF A01			
89-28476	15:3868	NTIS, PC A03/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NAL-TR–					
962	15:3892	NTIS (US Sales Only), PC A03/MF A01		DE88757171	
NAS–					
1.15:100745	15:2973	*See* N–89-26918			
1.15:101592	15:2977	*See* N–89-28035			
1.15:102091	15:3248	*See* N–89-28030			
1.15:102093	15:2296	*See* N–89-27705			
1.15:102102	15:2295	*See* N–89-27619			
1.15:102115	15:2976	*See* N–89-27795			
1.15:102123	15:2928	*See* N–89-27038			
1.15:102142	15:3206	*See* N–89-27115			
1.15:102295	15:2975	*See* N–89-27223			
1.15:102299	15:2292	*See* N–89-27623			
1.15:102301	15:2929	*See* N–89-27836			
1.15:102332	15:2974	*See* N–89-26989			
1.15:102335	15:2416	*See* N–89-27702			
1.21:494	15:3867	*See* N–89-28474			
1.26:179614-VOL-2	15:2464	*See* N–89-22981			
1.26:184583	15:3417	*See* N–89-17364			
1.26:184905	15:3203	*See* N–89-24538			
1.26:185117	15:2320	*See* N–89-27256			
1.26:185131	15:2780	*See* N–89-27700			
1.26:185353	15:3849	*See* N–89-27608			
1.26:185461	15:3361	*See* N–89-28454			
1.26:185501	15:4163	*See* N–89-27477			
1.26:185830	15:3868	*See* N–89-28476			
1.26:185833	15:3850	*See* N–89-27629			
1.26:185862	15:3866	*See* N–89-28471			
1.55:2493	15:3236	*See* N–89-17298			
NASA-CP–					
2493	15:3236	*See* N–89-17298			
NASA-CR–					
179614-VOL-2	15:2464	*See* N–89-22981			
182262	15:2783	*See* DOE/NASA–0352-3			
184583	15:3417	*See* N–89-17364			
184905	15:3203	*See* N–89-24538			
185117	15:2320	*See* N–89-27256			
185131	15:2780	*See* N–89-27700			
185163	15:2710	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002624	MF-712
185353	15:3849	*See* N–89-27608			
185461	15:3361	*See* N–89-28454			
185501	15:4163	*See* N–89-27477			
185830	15:3868	*See* N–89-28476			
185833	15:3850	*See* N–89-27629			
185862	15:3866	*See* N–89-28471			
NASA-SP–					
494	15:3867	*See* N–89-28474			
NASA-TM–					
100745	15:2973	*See* N–89-26918			
101592	15:2977	*See* N–89-28035			
102091	15:3248	*See* N–89-28030			
102093	15:2296	*See* N–89-27705			
102102	15:2295	*See* N–89-27619			
102115	15:2976	*See* N–89-27795			
102123	15:2928	*See* N–89-27038			
102142	15:3206	*See* N–89-27115			
102295	15:2975	*See* N–89-27223			
102299	15:2292	*See* N–89-27623			
102301	15:2929	*See* N–89-27836			
102332	15:2974	*See* N–89-26989			
102335	15:2416	*See* N–89-27702			
NCEER–					
89-0007	15:3254	*See* PB–89-218481/XAB			
NCRP–					
103	15:2692	National Council on Radiation Protection and Measurements, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814			
ND-R–					
1065(S)	15:2978	H.M. Stationery Office, London, price Pound 8.50			
NEACRP–					
302-L(Rev.)	15:4121	NTIS (US Sales Only), PC A17/MF A01		DE90721127	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NEANDC(J)–					
141/U	15:4157	*See* JAERI-M–89-129			
142/U	15:4119	*See* JAERI-M–89-143			
143/U	15:4427	*See* JAERI-M–89-167			
NEANDC–					
245-U	15:4121	*See* NEACRP–302-L(Rev.)			
NEANDC-E–					
292-U-Vol.III-Euratom	15:4193	NTIS (US Sales Only), PC A04/MF A01		DE90721238	
NEI-DK–					
179	15:2600	NTIS (US Sales Only), PC A04/MF A01 - OSTI		DE90705938	
210	15:2297	NTIS (US Sales Only), PC A03/MF A01		DE90718968	
211	15:3419	NTIS (US Sales Only), PC A03/MF A01		DE90718974	
212	15:2272	NTIS (US Sales Only), PC A03/MF A01		DE90718977	
213	15:2733	NTIS (US Sales Only), PC A04/MF A01		DE90718982	
214	15:2364	NTIS (US Sales Only), PC A05		DE90718986	
215	15:3110	NTIS (US Sales Only), PC A16/MF A01		DE90718997	
216	15:2734	NTIS (US Sales Only), PC A04/MF A01		DE90719030	
217	15:2266	NTIS (US Sales Only), PC A06/MF A01		DE90719033	
218	15:2428	NTIS (US Sales Only), PC A03/MF A01		DE90719047	
219	15:2139	NTIS (US Sales Only), PC A03/MF A01		DE90719068	
220	15:3420	NTIS (US Sales Only), PC A10/MF A01		DE90719157	
221	15:2365	NTIS (US Sales Only), PC A12		DE90719162	
222	15:2379	NTIS (US Sales Only), PC A03		DE90719250	
224	15:2561	NTIS (US Sales Only), PC A04/MF A01		DE90719259	
225	15:2347	NTIS (US Sales Only), PC A03/MF A01		DE90719264	
227	15:2735	NTIS (US Sales Only), PC A06/MF A01		DE90719294	
228	15:2380	NTIS (US Sales Only), PC A03/MF A01		DE90719297	
229	15:2761	NTIS (US Sales Only), PC A14/MF A01		DE90719301	
230	15:2762	NTIS (US Sales Only), PC A03/MF A01		DE90719311	
NEI-FI–					
14	15:2030	NTIS (US Sales Only), PC A09/MF A01		DE90719345	
NEI-SE–					
43	15:2638	NTIS (US Sales Only), PC A03/MF A01		DE90719395	
44	15:2625	NTIS (US Sales Only), PC A03/MF A01		DE90719396	
NERC–					
90002691	15:2639	North American Electric Reliability Council, 101 College Road East, Princeton, NJ 08540-6601			
NILU/OR–					
78/88	15:3421	NTIS (US Sales Only), PC A03/MF A01		DE90719389	
NIPER–					
417	15:2112	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000773	PC-122
438	15:2113	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002802	MF-122
443	15:2114	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002573	MF-122
NIR–					
1/88	15:3507	NTIS (US Sales Only), PC A07/MF A01		DE90721890	
NIRS-M–					
70	15:3570	NTIS (US Sales Only), PC A04/MF A01		DE90719693	
NIRS-R–					
15	15:4194	NTIS (US Sales Only), PC A06/MF A01		DE90719709	
NIST/TN–					
1325	15:2151	*See* PB–89-222608/XAB			
NISTIR–					
89-4086	15:2219	*See* NUREG/CR–5466			
89-4178	15:2214	*See* NUREG/CP–0103			
89/4107	15:3216	*See* PB–89-228290/XAB			
89/4118	15:3133	*See* PB–89-228308/XAB			
89/4119	15:3257	*See* PB–89-235899/XAB			
89/4131	15:3217	*See* PB–89-229025/XAB			
NMRI–					
88-23	15:3614	*See* AD-A–210773/8/XAB			
NOVEM–					
89-001	15:2677	*See* ETDE-mf–0722342			
89-002	15:2678	*See* ETDE-mf–0722344			
89-017	15:2702	*See* TNO-HMT–88-342			
89-018	15:2703	*See* TNO-HMT–88-342/Suppl			
89-039	15:2704	*See* TNO-HMT-R–88/253C			
NPS–					
61-89-010	15:3820	*See* AD-A–210441/2/XAB			
NRL-MR–					
6482	15:3798	*See* AD-A–210599/7/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NRL-MR–					
6486	15:3935	*See* AD-A–210465/1/XAB			
6518	15:3329	*See* AD-A–211248/0/XAB			
NRPB-R–					
225	15:2241	H.M. Stationery Office, London, price Pound 4.00			
NSF–					
87-311	15:3604	*See* PB–89-231773/XAB			
NSF-ITP–					
89-87-PAPER-1	15:3849	*See* N–89-27608			
NSWC-TR–					
89-110	15:2572	*See* AD-A–211254/8/XAB			
NUKEM-FuE–					
88041	15:4544	NTIS (US Sales Only), PC A05/MF A01		DE90722011	
NUREG–					
0383-Vol.1-Rev.12	15:2173	NTIS, PC A21/MF A01 - GPO - OSTI		TI90002160	
0383-Vol.2-Rev.12	15:2174	NTIS, PC A99/MF A01 - GPO - OSTI		TI90002161	
0383-Vol.3-Rev.9	15:3132	NTIS, PC A10/MF A01 - GPO; OSTI; INIS		TI90002159	
0540-Vol.2-No.7	15:2466	NTIS, PC A15/MF A01 - GPO - OSTI		TI90001684	
0540-Vol.2-No.8	15:2467	NTIS, PC A15/MF A01 - GPO; OSTI; INIS		TI90002526	
0775-Suppl.	15:3594	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI90002895	
0936-Vol.8-No.3	15:2468	NTIS, PC A07/MF A01 - GPO - OSTI		TI90002312	
1232-Vol.3-Suppl.1	15:2536	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI90002338	
1351	15:2213	NTIS, PC A09/MF A01 - GPO; OSTI; INIS		TI90002837	
1378	15:4522	NTIS, PC A07/MF A01 - GPO - OSTI		TI90002954	
1384-Vol.1	15:2537	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI90002279	
NUREG/CP–					
0102-Vol.1	15:2538	NTIS, PC A23/MF A01 - GPO; OSTI; INIS		TI90001527	
0103	15:2214	NTIS, PC A11/MF A01 - GPO; OSTI; INIS		TI90002097	
NUREG/CR–					
2850-Vol.8	15:2539	NTIS, PC A08/MF A01 - GPO; OSTI; INIS		TI90002504	
2907-Vol.8	15:2540	NTIS, PC A15/MF A01 - GPO; OSTI; INIS		TI90002736	
5215	15:2541	NTIS, PC A06/MF A01 - GPO - OSTI		TI90001480	
5225	15:2542	Q;I 05/MF A01 - OSTI		TI89004067	
5236	15:2543	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90002587	
5269	15:3813	NTIS, PC A21/MF A01 - GPO; OSTI; INIS		TI90002284	
5293	15:2544	NTIS, PC A03/MF A01 - GPO - OSTI		TI89009127	
5294	15:2545	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI90001904	
5364	15:2546	NTIS, PC A07/MF A01 - GPO; OSTI; INIS		TI90001756	
5395-Vol.4	15:2547	NTIS, PC E10/MF E01 - GPO; OSTI; INIS		TI90001687	
5395-Vol.6	15:2548	NTIS, PC E13/MF E02 - GPO; OSTI; INIS		TI90001686	
5395-Vol.7	15:2549	NTIS, PC E13/MF E01 - GPO; OSTI; INIS		TI90001688	
5395-Vol.8	15:2550	NTIS, PC E15/MF E02 - GPO; OSTI; INIS		TI90001689	
5418	15:3814	NTIS, PC A14/MF A01 - GPO; OSTI; INIS		TI90002677	
5429-Vol.2	15:3816	NTIS, PC A19/MF A01 - GPO - OSTI		TI90002158	
5430-Vol.1	15:2215	NTIS, PC A08/MF A01 - GPO; OSTI; INIS		TI90001927	
5430-Vol.2	15:2216	NTIS, PC A22/MF A01 - GPO; OSTI; INIS		TI90001753	
5430-Vol.3	15:2217	NTIS, PC A13/MF A01 - GPO; OSTI; INIS		TI90002162	
5441	15:2218	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI90003338	
5466	15:2219	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI90003156	
NUREG/IA–					
0028	15:2551	NTIS, PC A08/MF A01 - GPO; OSTI; INIS		TI90002126	
0029	15:2552	NTIS, PC A05/MF A01 - GPO; OSTI; INIS		TI90002127	
NVO–					
209-Rev.9	15:3388	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001812	PC-700
OCS/MMS–					
89-0058	15:2106	OSTI - US Dept. of Interior, Office of Offshore Information and Publications, Minerals Management Service, Mail Stop 642, 381 Elden Street, Herndon, VA 22070		TI90002652	
OITS–					
397	15:3979	*See* DOE/ER/40224–90			
400	15:3980	*See* DOE/ER/40224–91			
417	15:3981	*See* DOE/ER/40224–108			
419	15:3982	*See* DOE/ER/40224–110			
426	15:3983	*See* DOE/ER/40224–114			
OPTIMITURVE–					
2	15:2087	NTIS (US Sales Only), PC A03/MF A01		DE90719330	
3	15:2088	NTIS (US Sales Only), PC A03/MF A01		DE90719329	
5	15:2089	NTIS (US Sales Only), PC A03/MF A01		DE90719331	
6	15:2090	NTIS (US Sales Only), PC A03		DE90719332	
ORNL–					
6487	15:2693	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016676	MF-402; MF-407

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
6579	15:3746	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003104	MF-502
ORNL/FTR–					
3089	15:2979	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001303	MF-520
3107	15:2930	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002139	MF-336
3415	15:3747	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002511	MF-407
3420	15:2455	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002154	MF-522
3424	15:3422	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002067	MF-402
3429	15:3423	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002512	MF-402
3434	15:3424	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002829	MF-402
3437	15:2553	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002654	
3439	15:2594	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002660	MF-400
3445	15:2931	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002153	MF-406; MF-404
3446	15:4257	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002661	MF-404
3449	15:3425	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002653	MF-402
3451	15:2481	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002659	MF-520
3452	15:3426	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002747	MF-402
3455	15:3499	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002965	MF-402
3457	15:2220	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002921	MF-721
3458	15:2064	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002963	MF-400
3459	15:2065	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002964	MF-401
3473	15:2429	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003286	MF-104; MF-103
ORNL/M–					
948	15:3765	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002746	
993	15:2673	*See* DOE/HWP–94			
ORNL/PPA–					
89/1	15:2610	NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002799	MF-400
ORNL/RASA–					
87/36	15:3508	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002919	MF-511
88/18	15:3509	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001279	MF-507; MF-511
88/30	15:3510	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001278	MF-507; MF-511
89/5	15:3511	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003279	MF-511
89/7	15:3512	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003278	MF-511
89/8	15:3513	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003281	MF-511
89/9	15:3514	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003282	MF-511
ORNL/TM–					
11023	15:2170	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000977	PC-526
11120	15:3427	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002632	
11329	15:3483	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002507	MF-511
11335	15:2492	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001847	MF-400
ORNL/tr–					
89/40	15:2472	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002281	MF-406
89/42	15:2259	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002165	MF-406
89/46	15:2473	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002282	MF-406
OY/PSTL-TIED–					
63	15:2073	NTIS (US Sales Only), PC A05/MF A01		DE90719343	
P–					
300-89-016	15:2124	*See* CEC–90003094			
PAR-LPTHE–					
89/26	15:4041	*See* IC–89/258			
PARAMETER/IE–					
185	15:2545	*See* NUREG/CR–5294			
PATENTS-USA–					
4,837,361	15:2076	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,832,113	15:2494	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,842,963	15:2589	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,839,140	15:2896	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,840,816	15:2964	Patent and Trademark Office, Box 9, Washington, DC 20232			
Application7-356,496	15:2965	NTIS, PC A03/MF A01			
4,832,881	15:3036	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,839,316	15:3037	Patent and Trademark Office, Box 9, Washington, DC 20232			

PATENTS-USA–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
4,833,034	15:3038	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,839,133	15:3105	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,838,035	15:3141	Patent and Trademark Office, Box 9, Washington, DC 20232			
Application7-374,101	15:3233	NTIS, PC A03/MF A01			
4,837,442	15:3359	Patent and Trademark Office, Box 9, Washington, DC 20232			
Application7-386,095	15:3682	NTIS, PC A03/MF A01			
4,841,792	15:4533	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,841,550	15:4534	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,841,570	15:4549	Patent and Trademark Office, Box 9, Washington, DC 20232			
PB–					
89-184428/XAB	15:2694	NTIS, PC A08/MF A01			
89-185763/XAB	15:2611	NTIS, PC A03/MF A01			
89-205611/XAB	15:3549	NTIS, PC A03/MF A01			
89-205975/XAB	15:3484	NTIS, PC A06/MF A01			
89-207005/XAB	15:3550	NTIS, PC A03/MF A01			
89-208235/XAB	15:2980	NTIS, PC A05/MF A01			
89-210629/XAB	15:3571	NTIS, PC A03/MF A01			
89-211031/XAB	15:2146	NTIS, PC A05/MF A01			
89-211072/XAB	15:2711	NTIS, PC A09/MF A01			
89-213821/XAB	15:2786	NTIS, PC EE07			
89-213839/XAB	15:2795	NTIS, PC EE07			
89-213904/XAB	15:2695	NTIS, PC EE05			
89-214449/XAB	15:3551	NTIS, PC A05/MF A01			
89-215453/XAB	15:2456	NTIS, PC A04/MF A01			
89-215479/XAB	15:2712	NTIS, PC A09/MF A01			
89-215487/XAB	15:2713	NTIS, PC A24/MF A01			
89-215552/XAB	15:3552	NTIS, PC A06/MF A01			
89-215669/XAB	15:3428	NTIS, PC A03/MF A01			
89-216097/XAB	15:3429	NTIS, PC A07/MF A01			
89-216204/XAB	15:3678	NTIS, PC A07/MF A01			
89-217814/XAB	15:3430	NTIS, PC A08/MF A01			
89-218036/XAB	15:2714	NTIS, PC A05/MF A01			
89-218218/XAB	15:2430	NTIS, PC A03/MF A01			
89-218242/XAB	15:3249	NTIS, PC A03/MF A01			
89-218275/XAB	15:3766	NTIS, PC A03/MF A01			
89-218481/XAB	15:3254	NTIS, PC A09/MF A01			
89-218739/XAB	15:3393	NTIS, PC A06/MF A01			
89-218754/XAB	15:2640	NTIS, PC EE03/MF A01			
89-218770/XAB	15:3578	NTIS, PC A03/MF A01			
89-218788/XAB	15:3431	NTIS, PC A03/MF A01			
89-218796/XAB	15:2736	NTIS, PC A03/MF A01			
89-218804/XAB	15:3767	NTIS, PC A06/MF A01			
89-218812/XAB	15:3768	NTIS, PC A03/MF A01			
89-219224/XAB	15:3579	NTIS, PC A07/MF A01			
89-219430/XAB	15:2128	NTIS, PC A04/MF A01			
89-219539/XAB	15:3553	NTIS, PC A03/MF A01			
89-219612/XAB	15:3580	NTIS, PC A04/MF A01			
89-219620/XAB	15:3581	NTIS, PC A15/MF A01			
89-219984/XAB	15:3485	NTIS, PC A14/MF A01			
89-219992/XAB	15:3554	NTIS, PC A11/MF A01			
89-220024/XAB	15:3432	NTIS, PC A03/MF A01			
89-220701/XAB	15:2129	NTIS, PC A03/MF A01			
89-220719/XAB	15:2130	NTIS, PC A16/MF A01			
89-220727/XAB	15:2131	NTIS, PC A12/MF A01			
89-220891/XAB	15:3572	NTIS, PC A05/MF A01			
89-220925/XAB	15:2796	NTIS, PC A08/MF A01			
89-220941/XAB	15:3573	NTIS, PC A05/MF A01			
89-220958/XAB	15:3574	NTIS, PC A07/MF A01			
89-220966/XAB	15:2050	NTIS, PC A03/MF A01			
89-220974/XAB	15:3582	NTIS, PC A06/MF A01			
89-220990/XAB	15:3769	NTIS, PC A02/MF A01			
89-221014/XAB	15:3770	NTIS, PC A02/MF A01			
89-221030/XAB	15:3433	NTIS, PC A03/MF A01			
89-221055/XAB	15:3434	NTIS, PC A03/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-221113/XAB	15:3435	NTIS, PC A03/MF A01			
89-221139/XAB	15:3679	NTIS, PC A04/MF A01			
89-221204/XAB	15:3771	NTIS, PC A03/MF A01			
89-221220/XAB	15:3436	NTIS, PC A02/MF A01			
89-221246/XAB	15:3437	NTIS, PC A03/MF A01			
89-221253/XAB	15:3438	NTIS, PC A03/MF A01			
89-221261/XAB	15:3439	NTIS, PC A03/MF A01			
89-221279/XAB	15:3440	NTIS, PC A03/MF A01			
89-221287/XAB	15:3441	NTIS, PC A03/MF A01			
89-221337/XAB	15:3442	NTIS, PC A03/MF A01			
89-221345/XAB	15:3443	NTIS, PC A03/MF A01			
89-221352/XAB	15:3444	NTIS, PC A03/MF A01			
89-221360/XAB	15:2763	NTIS, PC A03/MF A01			
89-221410/XAB	15:2764	NTIS, PC A12/MF A01			
89-221428/XAB	15:2765	NTIS, PC A05/MF A01			
89-221436/XAB	15:3518	NTIS, PC A09/MF A01			
89-221444/XAB	15:2766	NTIS, PC A04/MF A01			
89-221451/XAB	15:2767	NTIS, PC A04/MF A01			
89-221469/XAB	15:2768	NTIS, PC A04/MF A01			
89-221477/XAB	15:2769	NTIS, PC A06/MF A01			
89-221485/XAB	15:2770	NTIS, PC A14/MF A01			
89-221493/XAB	15:2771	NTIS, PC A03/MF A01			
89-221501/XAB	15:2772	NTIS, PC A03/MF A01			
89-221519/XAB	15:2773	NTIS, PC A05/MF A01			
89-221527/XAB	15:2774	NTIS, PC A06/MF A01			
89-221535/XAB	15:3519	NTIS, PC A99/MF E10			
89-221543/XAB	15:3520	NTIS, PC A08/MF A01			
89-222277/XAB	15:2737	NTIS, PC A03/MF A01			
89-222285/XAB	15:2738	NTIS, PC A03/MF A01			
89-222319/XAB	15:2739	NTIS, PC A03/MF A01			
89-222327/XAB	15:2740	NTIS, PC A03/MF A01			
89-222475/XAB	15:2132	NTIS, PC A09/MF A01			
89-222483/XAB	15:3555	NTIS, PC A03/MF A01			
89-222590/XAB	15:2741	NTIS, PC A03/MF A01			
89-222608/XAB	15:2151	NTIS, PC A21/MF A01			
89-222624/XAB	15:3556	NTIS, PC A03/MF A01			
89-222665/XAB	15:3445	NTIS, PC A03/MF A01			
89-222673/XAB	15:3772	NTIS, PC A03/MF A01			
89-222681/XAB	15:3256	NTIS, PC A03/MF A01			
89-222707/XAB	15:3773	NTIS, PC A03/MF A01			
89-222715/XAB	15:3446	NTIS, PC A08/MF A01			
89-222723/XAB	15:3447	NTIS, PC A07/MF A01			
89-222798/XAB	15:3774	NTIS, PC A03/MF A01			
89-222806/XAB	15:3234	NTIS, PC A03/MF A01			
89-222814/XAB	15:2742	NTIS, PC A03/MF A01			
89-222830/XAB	15:3775	NTIS, PC A03/MF A01			
89-223341/XAB	15:3448	NTIS, PC A04/MF A01			
89-223606/XAB	15:3776	NTIS, PC A03/MF A01			
89-223622/XAB	15:3612	NTIS, PC A03/MF A01			
89-223630/XAB	15:3777	NTIS, PC A05/MF A01			
89-223663/XAB	15:2743	NTIS, PC A03/MF A01			
89-223721/XAB	15:3449	NTIS, PC A02/MF A01			
89-223804/XAB	15:3778	NTIS, PC A02/MF A01			
89-223853/XAB	15:2091	NTIS, PC A07/MF A01			
89-223903/XAB	15:2775	NTIS, PC A03/MF A01			
89-223952/XAB	15:3779	NTIS, PC A03/MF A01			
89-223960/XAB	15:3450	NTIS, PC A03/MF A01			
89-223986/XAB	15:3780	NTIS, PC A03/MF A01			
89-224000/XAB	15:3486	NTIS, PC A03/MF A01			
89-224067/XAB	15:2776	NTIS, PC A07/MF A01			
89-224075/XAB	15:2744	NTIS, PC A06/MF A01			
89-224109/XAB	15:2745	NTIS, PC A05/MF A01			
89-224117/XAB	15:2746	NTIS, PC A08/MF A01			
89-224125/XAB	15:2282	NTIS, PC EE99/MF E99			
89-224133/XAB	15:2283	NTIS, PC A07/MF A01			
89-224141/XAB	15:2284	NTIS, PC A99/MF A01			
89-224158/XAB	15:2285	NTIS, PC A21/MF A01			
89-224166/XAB	15:2286	NTIS, PC A06/MF A01			
89-224273/XAB	15:3487	NTIS, PC A06/MF A01			
89-224455/XAB	15:3557	NTIS, PC A11/MF A01			
89-224463/XAB	15:3451	NTIS, PC A03/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-224471/XAB	15:3452	NTIS, PC A06/MF A01			
89-224521/XAB	15:2696	NTIS, PC A03/MF A01			
89-224554/XAB	15:3781	NTIS, PC A03/MF A01			
89-224570/XAB	15:3782	NTIS, PC A03/MF A01			
89-224588/XAB	15:3783	NTIS, PC A03/MF A01			
89-224596/XAB	15:3784	NTIS, PC A03/MF A01			
89-224604/XAB	15:3558	NTIS, PC A11/MF A01			
89-224695/XAB	15:3559	NTIS, PC A19/MF A01			
89-224729/XAB	15:2747	NTIS, PC A05/MF A01			
89-224786/XAB	15:2748	NTIS, PC A06/MF A01			
89-224794/XAB	15:2749	NTIS, PC A05/MF A01			
89-224810/XAB	15:2127	NTIS, PC A10/MF A01			
89-224885/XAB	15:3560	NTIS, PC A04/MF A01			
89-224901/XAB	15:3583	NTIS, PC A06/MF A01			
89-224935/XAB	15:3575	NTIS, PC A03/MF A01			
89-224943/XAB	15:3453	NTIS, PC A07/MF A01			
89-224950/XAB	15:3521	NTIS, PC A06/MF A01			
89-224984/XAB	15:2601	NTIS, PC A02/MF A01			
89-224992/XAB	15:2602	NTIS, PC A03/MF A01			
89-225254/XAB	15:2750	NTISMF E04			
89-225403/XAB	15:3785	NTIS, PC A07/MF A01			
89-225411/XAB	15:3491	NTIS, PC A24/MF A01			
89-225486/XAB	15:3584	NTIS, PC A07/MF A01			
89-225494/XAB	15:3522	NTIS, PC A04/MF A01			
89-225510/XAB	15:3523	NTIS, PC A03/MF A01			
89-225528/XAB	15:3524	NTIS, PC A03/MF A01			
89-225536/XAB	15:3525	NTIS, PC A05/MF A01			
89-225544/XAB	15:3526	NTIS, PC A06/MF A01			
89-225577/XAB	15:3527	NTIS, PC A11/MF A01			
89-225585/XAB	15:3576	NTIS, PC A03/MF A01			
89-225601/XAB	15:3454	NTIS, PC A03/MF A01			
89-225627/XAB	15:3786	NTIS, PC A06			
89-225643/XAB	15:3585	NTIS, PC A05/MF A01			
89-225700/XAB	15:2932	NTIS, PC EE06/MF A01			
89-225908/XAB	15:3528	NTIS, PC A08/MF A01			
89-226484/XAB	15:2157	NTIS, PC A24/MF A01			
89-226492/XAB	15:2158	NTIS, PC A99/MF A01			
89-226500/XAB	15:2159	NTIS, PC A05/MF A01			
89-226799/XAB	15:2298	NTIS, PC A03/MF A01			
89-226856/XAB	15:3455	NTIS, PC A04/MF A01			
89-226930/XAB	15:2031	NTIS, PC A03/MF A01			
89-226948/XAB	15:2032	NTIS, PC A03/MF A01			
89-226955/XAB	15:2033	NTIS, PC A03/MF A01			
89-226963/XAB	15:2034	NTIS, PC A06/MF A01			
89-226971/XAB	15:2035	NTIS, PC A09/MF A01			
89-226989/XAB	15:2036	NTIS, PC A08/MF A01			
89-226997/XAB	15:2037	NTIS, PC A12/MF A01			
89-227003/XAB	15:2038	NTIS, PC A12/MF A01			
89-227011/XAB	15:2039	NTIS, PC A17/MF A01			
89-227029/XAB	15:2040	NTIS, PC A07/MF A01			
89-227037/XAB	15:2041	NTIS, PC A08/MF A01			
89-227045/XAB	15:2042	NTIS, PC A03/MF A01			
89-227052/XAB	15:2043	NTIS, PC A06/MF A01			
89-227078/XAB	15:2044	NTIS, PC A06/MF A01			
89-227086/XAB	15:2045	NTIS, PC A99/MF E12			
89-227094/XAB	15:2046	NTIS, PC A04/MF A01			
89-227847/XAB	15:3456	NTIS, PC A05/MF A01			
89-227862/XAB	15:3787	NTIS, PC A04/MF A01			
89-228290/XAB	15:3216	NTIS, PC A03/MF A01			
89-228308/XAB	15:3133	NTIS, PC A03/MF A01			
89-228720/XAB	15:3457	NTIS, PC A03/MF A01			
89-229025/XAB	15:3217	NTIS, PC A03/MF A01			
89-229355/XAB	15:2787	NTIS(Order as PB89-229348 PC$30.00)			
89-229421/XAB	15:2417	NTIS, PC A14/MF A01			
89-229504/XAB	15:3529	NTIS, PC A07/MF A01			
89-229512/XAB	15:3586	NTIS, PC A04/MF A01			
89-229520/XAB	15:3587	NTIS, PC A05/MF A01			
89-229538/XAB	15:3500	NTIS, PC A03/MF A01			
89-229546/XAB	15:3530	NTIS, PC A06/MF A01			
89-229553/XAB	15:3531	NTIS, PC A04/MF A01			
89-229561/XAB	15:3532	NTIS, PC A03/MF A01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-229579/XAB	15:3533	NTIS, PC A03/MF A01			
89-229587/XAB	15:3534	NTIS, PC A04/MF A01			
89-229595/XAB	15:3535	NTIS, PC A03/MF A01			
89-229652/XAB	15:2154	NTIS, PC A03/MF A01			
89-229819/XAB	15:3561	NTIS, PC A07/MF A01			
89-229975/XAB	15:3588	NTIS, PC A08/MF A01			
89-230106/XAB	15:2797	NTIS, PC A24/MF A01			
89-230189/XAB	15:2299	NTIS, PC A03/MF A01			
89-230239/XAB	15:3684	NTIS, PC A02/MF A01			
89-230247/XAB	15:3458	NTIS, PC A03/MF A01			
89-230254/XAB	15:3459	NTIS, PC A03/MF A01			
89-230510/XAB	15:2273	NTIS, PC A03/MF A01			
89-230551/XAB	15:3788	NTIS, PC A04/MF A01			
89-230619/XAB	15:2697	NTIS, PC A06/MF A01			
89-230627/XAB	15:2143	NTIS, PC A07/MF A01			
89-230635/XAB	15:2152	NTIS, PC A07/MF A01			
89-230643/XAB	15:2267	NTIS, PC A04/MF A01			
89-231575/XAB	15:2801	NTIS, PC A03/MF A01			
89-231583/XAB	15:2153	NTIS, PC A07/MF A01			
89-231609/XAB	15:2418	NTIS, PC A09/MF A01			
89-231617/XAB	15:3114	NTIS, PC A03/MF A01			
89-231773/XAB	15:3604	NTIS, PC A03/MF A01			
89-232599/XAB	15:2136	NTIS, PC A06/MF A01			
89-232607/XAB	15:2777	NTIS, PC A03/MF A01			
89-232615/XAB	15:2268	NTIS, PC A03/MF A01			
89-232631/XAB	15:2047	NTIS, PC A10/MF A01			
89-232649/XAB	15:2150	NTIS, PC A03/MF A01			
89-232755/XAB	15:3613	NTIS, PC A15/MF A01			
89-233464/XAB	15:3460	NTIS, PC A03/MF A01			
89-233894/XAB	15:3589	NTIS, PC A04/MF A01			
89-235105/XAB	15:2144	NTIS, PC A03/MF A01			
89-235212/XAB	15:3590	NTIS, PC A21/MF A01			
89-235279/XAB	15:3591	NTIS, PC A05/MF A01			
89-235899/XAB	15:3257	NTIS, PC A04/MF A01			
89-235949/XAB	15:2137	NTIS, PC A17/MF A01			
89-236418/XAB	15:2595	NTIS, PC A02/MF A01			
89-236590/XAB	15:2145	NTIS, PC A03/MF A01			
89-860035/XAB	15:3688	NTISPC N01/MF N01			
89-863856/XAB	15:3461	NTISPC N01/MF N01			
89-865075/XAB	15:2847	NTISPC N01/MF N01			
89-865182/XAB	15:3685	NTISPC N01/MF N01			
89-865208/XAB	15:3562	NTISPC N01/MF N01			
89-867741/XAB	15:2221	NTISPC N01/MF N01			
89-870505/XAB	15:2554	NTISPC N01/MF N01			
89-870521/XAB	15:2222	NTISPC N01/MF N01			
89-870570/XAB	15:2933	NTISPC N01/MF N01			
89-870612/XAB	15:2981	NTISPC N01/MF N01			
89-870646/XAB	15:2580	NTISPC N01/MF N01			
89-870869/XAB	15:2300	NTISPC N01/MF N01			
89-870885/XAB	15:2715	NTISPC N01/MF N01			
89-870893/XAB	15:2596	NTISPC N01/MF N01			
89-870901/XAB	15:2597	NTISPC N01/MF N01			
89-870935/XAB	15:3165	NTISPC N01/MF N01			
89-871057/XAB	15:3563	NTISPC N01/MF N01			
89-871107/XAB	15:2982	NTISPC N01/MF N01			
89-871115/XAB	15:4523	NTISPC N01/MF N01			
89-871123/XAB	15:2751	NTISPC N01/MF N01			
89-871198/XAB	15:3370	NTISPC N01/MF N01			
89-871214/XAB	15:3789	NTISPC N01/MF N01			
89-871230/XAB	15:3065	NTISPC N01/MF N01			
89-871248/XAB	15:2752	NTISPC N01/MF N01			
89-871263/XAB	15:2848	NTISPC N01/MF N01			
89-871297/XAB	15:2778	NTISPC N01/MF N01			
89-871339/XAB	15:3564	NTISPC N01/MF N01			
89-871628/XAB	15:2566	NTISPC N01/MF N01			
89-871974/XAB	15:2133	NTISPC N01/MF N01			
89-872006/XAB	15:3134	NTISPC N01/MF N01			
89-872055/XAB	15:3135	NTISPC N01/MF N01			
89-872063/XAB	15:3136	NTISPC N01/MF N01			
89-872360/XAB	15:2433	NTISPC N01/MF N01			
89-872584/XAB	15:3592	NTISPC N01/MF N01			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-872618/XAB	15:3218	NTISPC N01/MF N01			
89-872824/XAB	15:3219	NTISPC N01/MF N01			
89-873004/XAB	15:2469	NTISPC N01/MF N01			
89-900300/XAB	15:3790	NTISSubscription			
PCCF-T–					
88-16	15:3066	NTIS (US Sales Only), PC A09/MF A01		DE90721244	
88-18	15:4068	NTIS (US Sales Only), PC A08/MF A01		DE90721243	
PNCT-N–					
8410-89-008	15:2223	NTIS (US Sales Only), PC A03/MF A01		DE90719555	
8410-89-009	15:2224	NTIS (US Sales Only), PC A03/MF A01		DE90719554	
8410-89-010	15:3804	NTIS (US Sales Only), PC A03/MF A01		DE90719553	
PNL–					
4221-Vol.8	15:2539	*See* NUREG/CR–2850-Vol.8			
6732	15:2440	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001862	MF-810
6972	15:2243	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002513	MF-402
6982	15:3517	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002737	MF-920
6984	15:2698	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002738	MF-902
7103	15:3541	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002586	MF-606
7124	15:4195	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001780	MF-603
7130	15:2225	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003091	MF-903
7163	15:3462	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001813	MF-370
7166	15:3463	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002923	
PNL-SA–					
16209	15:2226	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002500	MF-510
16690	15:3748	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002893	MF-407
16734	15:2227	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002663	MF-814
16766	15:3515	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001893	MF-502
16809	15:3501	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002728	MF-502
16826	15:2228	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001900	MF-502
16844	15:2229	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001898	MF-603; MF-602
16859-HEDR	15:3749	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001899	MF-507
16874-HEDR	15:3750	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002723	MF-507; MF-502
16875	15:2598	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002732	MF-505
16907	15:2615	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001902	MF-500
16968	15:2753	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002734	MF-500
17004	15:4495	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002675	MF-500
17026	15:3751	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002665	MF-502
17036	15:2659	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002666	MF-110
17111	15:3819	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002676	
17164-HEDR	15:2230	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001991	MF-502
17250	15:2381	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002725	MF-261
17257	15:3371	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001903	MF-506; MF-501
17267	15:2231	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002733	MF-512
17311	15:2699	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002722	MF-232
17359	15:2232	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002673	MF-502
17367	15:3488	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002726	MF-502
17385	15:3464	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002727	MF-502
17443	15:2849	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002894	MF-404
POEF-M–					
19	15:2419	NTIS, PC A03/MF A01 - OSTI		DE90002230	MF-506
PPA-T–					
7	15:2244	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608330	
82	15:2983	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608085	
83	15:2255	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608596	
84	15:2850	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607971	
85	15:3080	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90607903	
86	15:2984	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608086	
88	15:2256	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608597	
89	15:2257	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608593	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
PPLK–					
10	15:4440	NTIS (US Sales Only), PC A11/MF A01		DE90719713	
PPLK-R–					
26	15:4343	NTIS (US Sales Only), PC A03/MF A01		DE90719524	
27	15:4344	NTIS (US Sales Only), PC A03/MF A01		DE90719523	
28	15:4441	NTIS (US Sales Only), PC A03/MF A01		DE90719522	
29	15:4345	NTIS (US Sales Only), PC A03/MF A01		DE90719521	
30	15:2851	NTIS (US Sales Only), PC A03/MF A01		DE90719525	
31	15:4346	NTIS (US Sales Only), PC A03/MF A01		DE90719520	
33	15:4347	NTIS (US Sales Only), PC A03/MF A01		DE90719519	
34	15:4348	NTIS (US Sales Only), PC A03/MF A01		DE90719518	
35	15:4349	NTIS (US Sales Only), PC A03/MF A01		DE90719532	
PPPL–					
2651	15:4350	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001819	PC-426
2660	15:4351	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003295	PC-426
PPRP/PPER-R–					
11	15:2456	*See* PB–89-215453/XAB			
PRRC–					
88-12	15:2146	*See* PB–89-211031/XAB			
RAL–					
89-026	15:3961	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90607643	
89-048	15:4045	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607100	
89-052	15:4046	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90607101	
89-070	15:3893	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000520	
89-077	15:4024	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000521	
RCNP-P–					
102	15:4069	NTIS (US Sales Only), PC A07/MF A01		DE90719707	
105	15:4164	NTIS (US Sales Only), PC A06/MF A01		DE90705941	
REPT–					
88-4Q	15:2157	*See* PB–89-226484/XAB			
89-1Q	15:2158	*See* PB–89-226492/XAB			
89B00215	15:2973	*See* N–89-26918			
RFP–					
4368	15:4524	NTIS, PC A03/MF A01 - OSTI		DE90002285	MF-705
4376	15:3465	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002286	MF-702
4377	15:2985	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002233	MF-721
RISO-M–					
2795	15:2382	NTIS (US Sales Only), PC A03/MF A01		DE90718936	
2798	15:2626	NTIS (US Sales Only), PC A04/MF A01		DE90718930	
2800	15:4525	NTIS (US Sales Only), PC A08/MF A01		DE90718926	
2801	15:3137	NTIS (US Sales Only), PC A03/MF A01		DE90719291	
2803	15:2562	NTIS (US Sales Only), PC A04/MF A01		DE90718933	
RISO-R–					
568	15:2361	NTIS (US Sales Only), PC A03/MF A01		DE90718922	
RRK–					
89-16	15:4287	NTIS (US Sales Only), PC A03/MF A01		DE90719556	
RRTAC–					
89-2	15:2079	Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5			
SAAS–					
372	15:4196	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608331	
373	15:4197	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608335	
374	15:4198	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608336	
375	15:4199	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608337	
SAIC–					
90003103	15:4526	OSTI; Science Applications International Corporation, 1710 Goodridge Drive, P.O. Box 1303, McLean, VA 22102		TI90003103	
SAND–					
86-2189C	15:3389	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002971	MF-741
88-2260	15:2541	*See* NUREG/CR–5215			
88-2535	15:2233	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002089	MF-721
88-2626C	15:2234	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002884	MF-814

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SAND–					
88-2734	15:2235	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001883	MF-721
89-0319C	15:3138	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001625	MF-705; MF-706
89-0386	15:2236	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001885	MF-721
89-0500	15:3226	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001800	MF-504
89-0567	15:2360	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002627	MF-400
89-0691	15:3081	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002359	MF-404
89-0917	15:2260	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002633	MF-600
89-1437C	15:3381	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001656	MF-704
89-1485	15:3139	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001802	MF-600
89-1508	15:3815	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001798	MF-700
89-1665C	15:2852	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003153	MF-704
89-1685	15:3894	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002804	MF-505
89-1711C	15:2853	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003162	MF-704
89-1755C	15:2476	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002103	
89-1832	15:2612	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001799	MF-900
89-2198C	15:3220	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002533	MF-706
89-2525C	15:4288	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002105	MF-700
89-2533C	15:4527	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002832	MF-705
89-2542C	15:3227	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002576	MF-706
89-2629C	15:3274	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002581	MF-712
89-2668C	15:3895	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002531	MF-706
89-7036	15:2301	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001786	MF-274
89-7039	15:2302	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002644	MF-275
89-7106	15:3308	NTIS, PC A06/MF A01 - OSTI		DE90002643	MF-712
89-7141C	15:3275	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002583	
SASR–					
10	15:3868	*See* N–89-28476			
11	15:3868	*See* N–89-28476			
12	15:3868	*See* N–89-28476			
13	15:3868	*See* N–89-28476			
SC–					
5441.FTR	15:2809	*See* AD-A–211154/0/XAB			
SEA–					
87-253-08-A:1	15:2543	*See* NUREG/CR–5236			
SERI/CP–					
254-3000	15:2700	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009490	
SERI/STR–					
211-3410	15:2303	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000846	MF-271
211-3582	15:2304	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009495	MF-271
211-3583	15:2305	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009496	MF-271
211-3585	15:2306	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009498	MF-270
211-3586	15:2307	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009499	MF-273
257-3479	15:2383	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009445	MF-261
SERI/TP–					
211-3595	15:2308	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009506	MF-270
257-3591	15:2384	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009501	MF-261
SIEMENS-KWU-U9–					
414/88/022	15:2555	NTIS (US Sales Only), PC A04/MF A01		DE90722092	
SL–					
1251-85195-20	15:2385	NTIS (US Sales Only), PC A03/MF A01		DE90719284	
SLAC–					
343	15:3962	NTIS, PC A99/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001785	PC-414
347	15:3963	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002629	PC-414
350	15:3964	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002638	PC-414
SLAC-PUB–					
4984	15:3965	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001814	PC-414
5048	15:3966	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001815	PC-414
5060	15:3277	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001816	PC-414
5066	15:3357	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90000943	PC-412
5086	15:3278	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001817	PC-414
5118	15:3967	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001818	PC-414
SLAC-TN–					
89-1	15:3309	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002797	MF-414
89-2	15:3310	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002798	MF-414
SLAC/AP–					
76	15:3276	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002803	MF-414
SLU-ISK–					
179	15:2274	NTIS (US Sales Only), PC A04/MF A01		DE90719393	
SMU–					
5-25105	15:4501	*See* AD-A–210722/5/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SNV–					
3593	15:3565	NTIS (US Sales Only), PC A06/MF A01		DE90719417	
3609	15:3467	*See* SVF–336			
SOL–					
89-7	15:4545	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000022	MF-405
89-11	15:4546	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017330	MF-405
89-12	15:4547	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017331	MF-405
89-14	15:4548	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002651	MF-405
89-15	15:4528	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003101	MF-405
89-16	15:4529	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003102	MF-405
SPI–					
25-1-VOL-2	15:2464	*See* N–89-22981			
SRI-ECU–					
1243	15:4500	*See* AD-A–210528/6/XAB			
SRI-ENV–					
89-208-6666	15:2423	*See* DOE/PC/88868–T3			
SRI-MP–					
89-038	15:2153	*See* PB–89-231583/XAB			
STEV–					
1989-R5	15:2135	NTIS (US Sales Only), PC A05/MF A01		DE90719392	
STEV-FBT–					
89-24	15:3250	NTIS (US Sales Only), PC A03		DE90719434	
89-25	15:3466	NTIS (US Sales Only), PC A02/MF A01		DE90719435	
89-26	15:2074	NTIS (US Sales Only), PC A02/MF A01		DE90719436	
89-27	15:2101	NTIS (US Sales Only), PC A03/MF A01		DE90719437	
STEV-VIND–					
89-17	15:2386	NTIS (US Sales Only), PC A03/MF A01		DE90719438	
STF–					
15A88028	15:2701	NTIS (US Sales Only), PC A03/MF A01		DE90719391	
STU–					
86-4162	15:2275	NTIS (US Sales Only), PC A05		DE90719415	
STU-I–					
707-1988	15:2613	NTIS (US Sales Only), PC A05/MF A01		DE90719394	
STUK-A–					
86	15:2450	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608737	
STUK-B-YTO–					
54	15:2451	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608738	
56	15:2452	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608739	
SU-CTR-S–					
88	15:3203	*See* N–89-24538			
SV–					
2000-352-2	15:2641	NTIS (US Sales Only), PC A05		DE90719412	
SVF–					
336	15:3467	NTIS (US Sales Only), PC A05/MF A01		DE90719408	
339	15:2854	NTIS (US Sales Only), PC A04/MF A01		DE90719409	
340	15:2779	NTIS (US Sales Only), PC A06		DE90719410	
341	15:2754	NTIS (US Sales Only), PC A04/MF A01		DE90719411	
SWRI–					
06-7963	15:2783	*See* DOE/NASA–0352-3			
1604	15:2796	*See* PB–89-220925/XAB			
TDA–					
89-GRI-002	15:2267	*See* PB–89-230643/XAB			
TNO-HMT–					
88-342	15:2702			DE90722472	
88-342/Suppl	15:2703			DE90722473	
TNO-HMT-R–					
88/253C	15:2704			DE90722455	
TR–					
0086A(2060)-2	15:3149	*See* AD-A–210844/7/XAB			
0088(3907)-1	15:3142	*See* AD-A–210613/6/XAB			
0088(3930-04)-2	15:3146	*See* AD-A–210769/6/XAB			
0089(4925-07)-1	15:3222	*See* AD-A–210264/8/XAB			
0089(4925-07)-3	15:3360	*See* AD-A–210502/1/XAB			
1	15:3145	*See* AD-A–210758/9/XAB			
2	15:2567	*See* AD-A–210755/5/XAB			
2	15:3328	*See* AD-A–210282/0/XAB			
165	15:3401	*See* AD-A–211029/4/XAB			
33	15:4502	*See* AD-A–210743/1/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
6-ONR	15:2570	*See* AD-A–210978/3/XAB			
7-ONR	15:2571	*See* AD-A–210979/1/XAB			
90	15:2806	*See* AD-A–210307/5/XAB			
TR-EL–					
82-3/82(11.113)	15:3537	*See* BR–82(11.113)			
82-4/82(11.111)	15:3536	*See* BR–82(11.111)			
TRR–					
87-26	15:2980	*See* PB–89-208235/XAB			
TTI–					
2-10-84-339-14	15:2711	*See* PB–89-211072/XAB			
UAG-CONTRIB-SER-A–					
12	15:3885	*See* AD-A–955597/0/XAB			
UBA-FB–					
88-019	15:3566	Copy held by UB/TIB Hannover			
UCB-NE–					
4136	15:2207	*See* LBL–26704			
4137	15:2206	*See* LBL–26703			
4149	15:2211	*See* LBL–27225			
4156	15:2212	*See* LBL–27429			
UCID–					
21674	15:4488	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001796	
21682	15:3468	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002635	MF-702
21744	15:4352	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002636	MF-422
21775-Vol.1	15:2650	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003086	MF-402; MF-407
21775-Vol.2	15:2651	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003087	MF-402; MF-407
21796	15:4530	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001794	MF-705
21810	15:4442	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001795	MF-721
21822	15:3791	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001790	MF-502
21823	15:3792	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001789	MF-507
21824	15:3752	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001788	MF-502
UCLA/PPG–					
1135	15:4443	NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001808	PC-420
UCRL–					
100432	15:4445	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002795	MF-706
100533	15:4446	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002821	MF-712
100596-Rev.1	15:4258	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002974	MF-706
100603	15:2239	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002816	MF-802
100641	15:3140	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002818	MF-700
100702	15:3680	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002508	MF-708
100752	15:4236	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001990	MF-700
100763	15:4122	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002810	MF-700
100794	15:3390	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002784	MF-703
100797	15:2856	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001895	MF-701
100810	15:3221	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002809	MF-700
100847	15:3207	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003053	MF-501
100891	15:3167	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002822	MF-414
100936	15:3516	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002973	MF-742
101088	15:4237	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002786	MF-411
101105	15:4358	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002982	MF-422
101113	15:4447	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002790	MF-712
101145	15:4448	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002789	MF-712
101148	15:4449	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002787	MF-712
101247-Pts.1-2	15:3898	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003025	MF-712
101285	15:2240	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002817	MF-814
101481	15:4450	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002995	MF-422
101649	15:4451	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003023	MF-712
101756	15:4452	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002819	MF-516
101879	15:3382	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002785	MF-741
101915	15:3267	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002975	MF-700
101996	15:3469	NTIS, PC A03/MF A01 - OSTI		DE90002108	MF-702
102028	15:2988	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002224	MF-700
102044	15:3168	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002754	MF-712
21212	15:3489	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001145	MF-702
21227-89	15:2309	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001655	
21229	15:2581	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002527	
21248	15:4353	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002825	MF-414
21249	15:3279	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002827	MF-712
21250	15:4354	OSTI; GPO Dep.	E 1.99:	DE90002828	MF-712
21254	15:3166	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003024	MF-712

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
21256	15:3896	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002815	MF-712
21257	15:3897	NTIS, PC A04/MF A01 - OSTI		DE90002824	MF-700; MF-701
52000-89-10	15:4355	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002620	PC-700
53935	15:3372	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001793	MF-701
97265	15:4356	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002886	MF-705
97266	15:4357	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002888	MF-705
98191	15:4444	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003014	MF-420
98308	15:2237	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002976	MF-703
98434	15:2802	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001894	MF-700
98583	15:2986	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001896	MF-701
98656	15:2987	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002235	MF-702
98729	15:2238	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002820	MF-814
98780	15:2855	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003058	MF-704
99673-Rev.1	15:4531	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002813	MF-705
UCRL-Trans–					
12253	15:2934	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002060	MF-410
UJV–					
8715-V	15:4496	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608893	
UMTA-DC–					
06-0610-88	15:2712	*See* PB–89-215479/XAB			
USCG-D–					
08-89	15:2653	*See* AD-A–210630/0/XAB			
USGS/WRD/HD–					
89/264	15:3559	*See* PB–89-224695/XAB			
VTT-TIED–					
1028	15:2707	NTIS (US Sales Only), PC A06/MF A01		DE90719347	
829	15:2705	NTIS (US Sales Only), PC A03/MF A01		DE90719348	
944	15:3251	NTIS (US Sales Only), PC A03/MF A01		DE90719342	
982	15:2706	NTIS (US Sales Only), PC A05/MF A01		DE90719346	
985	15:3252	NTIS (US Sales Only), PC A04/MF A01		DE90719337	
986	15:2287	NTIS (US Sales Only), PC A07/MF A01		DE90719338	
987	15:2288	NTIS (US Sales Only), PC A06/MF A01		DE90719339	
988	15:2289	NTIS (US Sales Only), PC A05/MF A01		DE90719340	
989	15:2290	NTIS (US Sales Only), PC A04/MF A01		DE90719341	
VTT-TUTK–					
621	15:2755	NTIS (US Sales Only), PC A07/MF A01		DE90719344	
622	15:3115	NTIS (US Sales Only), PC A06/MF A01		DE90719334	
990	15:3253	NTIS (US Sales Only), PC A05/MF A01		DE90719335	
WEG–					
25-4062	15:2362	*See* ETSU-WN–5063			
WEG-T–					
4119	15:2363	*See* ETSU-WN–5098			
WES/MP/E–					
89-1	15:3544	*See* AD-A–211198/7/XAB			
WES/TR/E–					
89-2	15:3543	*See* AD-A–211153/2/XAB			
WHC-SA–					
0616	15:2171	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003361	MF-732
0726	15:4532	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001478	MF-600
WHOI–					
76-5	15:3573	*See* PB–89-220941/XAB			
76-93	15:3574	*See* PB–89-220958/XAB			
WIS-WRC–					
89-01	15:3560	*See* PB–89-224885/XAB			
WORLD-BANK-TP–					
93	15:2750	*See* PB–89-225254/XAB			
WRDC-TR–					
89-2021	15:2119	*See* AD-A–210188/9/XAB			
WSRC-RP–					
89-355	15:2165	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001307	MF-706
WSRC-tr–					
122	15:2756	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001716	MF-706
123	15:2757	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001714	MF-701
YJT–					
89-08	15:2436	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608689	
YM–					
5501	15:2647	*See* ETSU-GEN–2006-P2			

Order Number Correlation

The correlation list is provided for those organizations that file documents by report number but may receive requests by order number. For more information about a document, refer to the Report Number Index.

Order No.	*Report No.*
DE88757171	NAL-TR-962
DE89000771	DOE/SF/00098-T14
DE89000773	NIPER-417
DE89000846	SERI/STR-211-3410
DE89000979	DOE/MC/23140-2695
DE89004682	DOE/ER/03956-T4
DE89008725	CONF-890422-1
DE89009245	DOE/CE/64615-T2-Exec.Summ.
DE89009445	SERI/STR-257-3479
DE89009464	DOE/CH/10093-57
DE89009490	SERI/CP-254-3000
DE89009495	SERI/STR-211-3582
DE89009496	SERI/STR-211-3583
DE89009498	SERI/STR-211-3585
DE89009499	SERI/STR-211-3586
DE89009501	SERI/TP-257-3591
DE89009506	SERI/TP-211-3595
DE89011683	DOE/METC-89/6103
DE89011684	DOE/LC/11066-2719-Vol.1
DE89011695	DOE/MC/22123-2735-Vol.1
DE89011696	DOE/MC/22123-2735-Vol.2
DE89011701	DOE/LC/11075-2737
DE89014027	LA-UR-89-1909
DE89014543	EPA-520/5-88-018
DE89016440	DOE/CE/15407-T1
DE89016618	DOE/ET/53088-370
DE89016676	ORNL-6487
DE89017330	SOL-89-11
DE89017331	SOL-89-12
DE89618065	LHRL-LIB/Trans-3
DE89781528	CEA-CONF-9289
DE89901266	CRIE-T-87066
DE89908088	CSTB-PC-661
DE90000022	SOL-89-7
DE90000126	LBL-27339
DE90000401	DOE/MC/25151-2745
DE90000520	RAL-89-070
DE90000521	RAL-89-077
DE90000641	DOE/PC/79902-T1
DE90000717	JINR-E-6-89-411
DE90000719	JINR-E-11-89-174
DE90000772	DOE/ER/40150-89
DE90000943	SLAC-PUB-5066
DE90000977	ORNL/TM-11023
DE90001079	CONF-890902-20
DE90001145	UCRL-21212
DE90001224	DOE/PC/79680-T2
DE90001278	ORNL/RASA-88/30
DE90001279	ORNL/RASA-88/18
DE90001303	ORNL/FTR-3089
DE90001307	WSRC-RP-89-355
DE90001331	BNL-43086
DE90001400	DOE/PC/91101-T8
DE90001435	CONF-8909141-5-Draft
DE90001442	CONF-8909141-3
DE90001460	DOE/PC/90910-T1
DE90001464	DOE/ER/60631-T4
DE90001465	DOE/ER/60631-2
DE90001469	DOE/CE/15449-T1
DE90001478	WHC-SA-0726
DE90001532	BNL-42573
DE90001533	BNL-43298
DE90001564	CONF-8901166-1
DE90001565	CONF-8906236-1
DE90001570	LBL-27680
DE90001574	FNAL/C-89/194
DE90001588	DOE/EIA-0321/1(87)
DE90001596	CONF-8707219-1
DE90001625	SAND-89-0319C
DE90001642	CONF-8909242-1
DE90001645	CONF-8910248-1
DE90001655	UCRL-21227-89
DE90001656	SAND-89-1437C
DE90001662	BNWL-CC-2048
DE90001694	DOE/PC/79933-8
DE90001714	WSRC-tr-123
DE90001716	WSRC-tr-122
DE90001730	CONF-8910259-1-Vugraphs
DE90001749	EGG-M-89101
DE90001759	CONF-8909141-7
DE90001760	CONF-8909263-1
DE90001761	CONF-8909141-8
DE90001764	CONF-8909257-1
DE90001768	CONF-890855-58
DE90001769	CONF-8908177-1
DE90001770	CONF-890855-57
DE90001771	CONF-8906241-1
DE90001772	CONF-8908178-1
DE90001776	LA-11662-MS
DE90001779	DOE/NE-0098
DE90001780	PNL-7124
DE90001782	ANL/EES-TM-378
DE90001784	DOE/ER-0412
DE90001785	SLAC-343
DE90001786	SAND-89-7036
DE90001788	UCID-21824
DE90001789	UCID-21823
DE90001790	UCID-21822
DE90001791	DOE/ER-0425
DE90001792	DOE/FE-0141
DE90001793	UCRL-53935
DE90001794	UCID-21796
DE90001795	UCID-21810
DE90001796	UCID-21674
DE90001797	FNAL-TM-1620
DE90001798	SAND-89-1508
DE90001799	SAND-89-1832
DE90001800	SAND-89-0500
DE90001802	SAND-89-1485
DE90001804	ANL-88-37
DE90001807	ANL-89/28
DE90001808	UCLA/PPG-1135
DE90001809	LA-11670-PR
DE90001811	LA-11567-MS
DE90001812	NVO-209-Rev.9
DE90001813	PNL-7163
DE90001814	SLAC-PUB-4984
DE90001815	SLAC-PUB-5048
DE90001816	SLAC-PUB-5060
DE90001817	SLAC-PUB-5086
DE90001818	SLAC-PUB-5118
DE90001819	PPPL-2651
DE90001836	LA-UR-89-3068
DE90001847	ORNL/TM-11335
DE90001862	PNL-6732
DE90001875	FNAL-TM-1622
DE90001883	SAND-88-2734
DE90001885	SAND-89-0386
DE90001889	CONF-8806370-
DE90001892	DOE/EH-0101
DE90001893	PNL-SA-16766
DE90001894	UCRL-98434
DE90001895	UCRL-100797
DE90001896	UCRL-98583
DE90001898	PNL-SA-16844
DE90001899	PNL-SA-16859-HEDR
DE90001900	PNL-SA-16826
DE90001902	PNL-SA-16907
DE90001903	PNL-SA-17257
DE90001905	CONF-8911110-1
DE90001906	CONF-8911109-1
DE90001909	CONF-8911108-1
DE90001910	CONF-891113-5
DE90001911	CONF-891132-7
DE90001912	CONF-8910275-1
DE90001914	CONF-8910107-2
DE90001918	CONF-891132-8
DE90001919	CONF-890982-5
DE90001920	CONF-891103-34
DE90001922	CONF-891140-4
DE90001924	CONF-891140-3
DE90001926	CONF-8911107-1
DE90001928	CONF-8910274-1
DE90001931	CONF-8910273-1
DE90001936	DOE/SR/14069-2
DE90001938	CONF-8910276-1
DE90001940	CONF-891053-5
DE90001942	CONF-8910274-2
DE90001945	DOE/PC/88877-T3
DE90001946	DOE/PC/79921-T6
DE90001947	DOE/PC/88868-T3
DE90001963	CONF-8910120-1
DE90001975	CONF-8910222-3
DE90001982	CONF-8909254-1
DE90001990	UCRL-100752
DE90001991	PNL-SA-17164-HEDR
DE90001995	EGG-M-88156
DE90001998	EGG-M-38887
DE90001999	EGG-M-32787
DE90002001	EGG-M-88277
DE90002003	EGG-M-36787
DE90002004	EGG-M-88477
DE90002005	DOE/ID-10233(88)
DE90002006	DOE/ID-10216-Vol.6
DE90002007	EGG-M-89361
DE90002009	EGG-M-88154
DE90002010	EGG-M-88270
DE90002012	EGG-M-88264
DE90002013	EGG-M-88275
DE90002016	EGG-M-88115
DE90002017	EGG-M-34487
DE90002020	EGG-M-89209

Order No.	Report No.
DE90002021	EGG-M-89119
DE90002023	DOE/ID-10219
DE90002027	EGG-M-88469
DE90002028	EGG-EP-8708
DE90002029	EGG-M-89182
DE90002030	EGG-M-89437
DE90002031	EGG-M-88428
DE90002032	EGG-M-88438
DE90002042	EGG-M-89322
DE90002044	EGG-M-88163
DE90002045	EGG-M-89380
DE90002046	EGG-M-88501
DE90002047	EGG-M-89193
DE90002049	DOE/ID-10243
DE90002053	EGG-M-88268
DE90002055	EGG-M-88271
DE90002058	EGG-M-89153
DE90002060	UCRL-Trans-12253
DE90002067	ORNL/FTR-3424
DE90002068	EGG-M-89186
DE90002070	LBL-27833
DE90002073	EGG-M-88376
DE90002074	EGG-EAST-8546
DE90002075	EGG-M-88300
DE90002076	EGG-M-89302
DE90002078	EGG-M-37087
DE90002081	EGG-M-36587
DE90002082	EGG-M-36387
DE90002085	EGG-M-89258
DE90002086	EGG-M-88357
DE90002087	CONF-8910239-3
DE90002089	SAND-88-2535
DE90002090	EGG-EP-8581
DE90002091	EGG-M-88288
DE90002092	EGG-M-88181
DE90002094	EGG-M-88260
DE90002103	SAND-89-1755C
DE90002105	SAND-89-2525C
DE90002108	UCRL-101996
DE90002110	FNAL/C-89/163-T
DE90002115	DOE/ER/40281-4
DE90002121	LBL-27452
DE90002139	ORNL/FTR-3107
DE90002146	EGG-M-88261
DE90002150	CONF-891007-31
DE90002153	ORNL/FTR-3445
DE90002154	ORNL/FTR-3420
DE90002155	CONF-8911114-1
DE90002163	DOE/ER/45182-5
DE90002165	ORNL/tr-89/42
DE90002166	LBL-27664
DE90002167	CONF-8907103-12
DE90002168	CONF-890659-3
DE90002170	CONF-8906244-1
DE90002171	CONF-890899-2
DE90002172	CONF-8908133-6
DE90002174	CONF-890826-5
DE90002175	CONF-890841-3
DE90002177	CONF-890841-4
DE90002178	CONF-890814-9
DE90002179	CONF-8908170-2
DE90002184	CONF-890770-3
DE90002186	FNAL/C-89/207-E
DE90002187	CONF-8907161-1
DE90002190	CONF-890790-3
DE90002191	CONF-8907113-13
DE90002192	CONF-890756-3
DE90002194	CONF-8906240-1
DE90002195	CONF-890555-23
DE90002198	CONF-8905126-7
DE90002199	CONF-8905188-2
DE90002202	CONF-8905143-19
DE90002203	CONF-8906119-4
DE90002204	CONF-8906247-1
DE90002205	ANL-HEP-CP-89-109
DE90002206	CONF-8906246-1
DE90002208	CONF-890686-3
DE90002210	CONF-8906112-2
DE90002211	CONF-890673-5
DE90002213	CONF-8905239-1
DE90002215	CONF-8906243-1
DE90002217	CONF-890480-2
DE90002218	DOE/ID-10252
DE90002222	CONF-8602126-
DE90002224	UCRL-102028
DE90002226	ANL-HEP-CP-89-69
DE90002230	POEF-M-19
DE90002231	EGG-HFRU-8654
DE90002233	RFP-4377
DE90002235	UCRL-98656
DE90002245	LBL-PUB-630-Rev./10-89
DE90002249	CONF-8903173-1
DE90002255	CONF-8904281-1
DE90002256	CONF-890437-13
DE90002260	CONF-880810-2
DE90002263	CONF-8904288-1
DE90002266	CONF-8904290-3
DE90002268	CONF-8904290-1
DE90002270	CONF-8904290-2
DE90002272	CONF-8904289-1
DE90002273	CONF-8911106-1
DE90002278	LA-11652-MS
DE90002280	DOE/OR/21548-045-Rev.0
DE90002281	ORNL/tr-89/40
DE90002282	ORNL/tr-89/46
DE90002285	RFP-4368
DE90002286	RFP-4376
DE90002289	BNL-43348
DE90002292	BNL-43127-Rev.
DE90002293	BNL-43281
DE90002295	BNL-43385
DE90002296	BNL-43347
DE90002297	BNL-43350
DE90002298	BNL-43372
DE90002299	BNL-43345
DE90002300	DOE/PC/88561-T1
DE90002301	BNL-43112
DE90002302	BNL-43344
DE90002303	BNL-43108
DE90002310	BNL-43367
DE90002328	LBL-27826
DE90002332	LBL-27380
DE90002337	LA-11634-MS
DE90002343	DOE/ER/53263-7
DE90002345	LA-UR-89-3289
DE90002350	LA-UR-89-3277
DE90002352	LA-UR-89-3275
DE90002354	LA-UR-89-3268
DE90002359	SAND-89-0691
DE90002377	LBL-27657
DE90002380	LA-UR-89-3465
DE90002381	LA-UR-89-3438
DE90002382	LA-UR-89-3431
DE90002384	LA-UR-89-3410
DE90002385	LA-UR-89-3407
DE90002386	LA-UR-89-3406
DE90002387	LA-UR-89-3397
DE90002388	LA-UR-89-3395
DE90002389	LA-UR-89-3394
DE90002393	LA-UR-89-3380
DE90002397	LA-UR-89-3537
DE90002398	LA-UR-89-3535
DE90002400	DOE/PC/90527-T8
DE90002402	LA-UR-89-3503
DE90002404	LA-UR-89-3498
DE90002408	LA-UR-89-3616
DE90002409	LA-UR-89-3600
DE90002412	LA-UR-89-3581
DE90002423	K/ITP-111
DE90002428	CONF-890906-6
DE90002429	CONF-8909236-2
DE90002431	LA-UR-89-3361
DE90002432	LA-UR-89-3355
DE90002433	LA-UR-89-3354
DE90002436	LA-UR-89-3342
DE90002437	LA-UR-89-3337
DE90002439	LA-UR-89-3334
DE90002440	LA-UR-89-3331
DE90002445	LA-UR-89-3297
DE90002447	LA-UR-89-3292
DE90002449	LBL-24805-Rev.
DE90002450	LBL-27743
DE90002451	LBL-27763
DE90002452	LBL-27599
DE90002453	LBL-27423
DE90002454	LBL-27867
DE90002455	LBL-27748
DE90002456	LBL-27692
DE90002458	BNL-43214
DE90002460	LBL-27627
DE90002461	LBL-27649
DE90002462	LBL-27904
DE90002463	LBL-26906
DE90002464	CONF-891007-75
DE90002469	CONF-8911117-1
DE90002470	CONF-891007-72
DE90002472	CONF-8910284-1
DE90002474	CONF-891117-8
DE90002477	CONF-8910222-5
DE90002478	CONF-8910222-4
DE90002479	CONF-891093-9
DE90002480	CONF-891013-7
DE90002482	CONF-8910222-6
DE90002483	IAEA-SM-310/63P
DE90002487	CONF-891007-78
DE90002488	CONF-891007-77
DE90002489	CONF-8909242-2
DE90002490	DOE/WIPP-89-007
DE90002491	DOE/WIPP-89-014
DE90002492	DOE/WIPP-89-009-Vol.1
DE90002493	DOE/WIPP-89-009-Vol.2
DE90002494	CONF-891113-6
DE90002500	PNL-SA-16209
DE90002507	ORNL/TM-11329
DE90002508	UCRL-100702
DE90002509	CONF-890619-9
DE90002511	ORNL/FTR-3415
DE90002512	ORNL/FTR-3429
DE90002513	PNL-6972
DE90002517	HW-32809
DE90002518	HW-33128
DE90002520	HW-34461
DE90002521	HW-39558
DE90002522	DOE/ER/13897-10
DE90002524	DOE/ER/45199-T2
DE90002525	DOE/ER/05490-107
DE90002527	UCRL-21229
DE90002528	LBL-26612-Vol.2
DE90002531	SAND-89-2668C
DE90002533	SAND-89-2198C
DE90002536	DOE/SF/16306-18
DE90002537	LA-UR-89-3174
DE90002539	DOE/ER/40273-4
DE90002540	DOE/ER/60647-2
DE90002541	DOE/ER/60588-3
DE90002542	DOE/ER/60692-2

Order No.	Report No.
DE90002543	DOE/ER/53192–40
DE90002544	DOE/ER/13581–3
DE90002545	DOE/ER/40417–4
DE90002551	DOE/DP/50066–T1
DE90002553	DOE/ER/60549–3
DE90002554	DOE/ER/60549–4
DE90002555	DOE/FE/60850–T1
DE90002561	DOE/CE/15407–T2
DE90002562	DOE/ER/13732–2
DE90002563	DOE/ER/40389–54
DE90002565	DOE/ER/40389–62
DE90002566	DOE/ER/40389–61
DE90002567	DOE/ER/40389–57
DE90002568	DOE/ER/40389–56
DE90002569	DOE/EIA–0219(88)
DE90002573	NIPER–443
DE90002576	SAND–89-2542C
DE90002581	SAND–89-2629C
DE90002583	SAND–89-7141C
DE90002586	PNL–7103
DE90002590	BNL–43361
DE90002592	DOE/EIA–0130(89/08)
DE90002595	DOE/EIA–0109(89/08)
DE90002596	ANL/TM–474
DE90002600	LBL–27466
DE90002602	LBL–27226
DE90002603	LBL–27140
DE90002604	LBL–27037
DE90002605	LBL–27289
DE90002606	LBL–20090
DE90002607	LBL–20645
DE90002608	LBL–20333
DE90002609	LBL–20332
DE90002610	LBL–22642
DE90002612	LBL–27131
DE90002614	LBL–26780
DE90002617	LBL–26362
DE90002618	LBL–27000
DE90002619	ANL/CNSV–69
DE90002620	UCRL–52000-89-10
DE90002621	LA–11651-MS
DE90002624	NASA-CR–185163
DE90002625	DOE/PE–0093
DE90002627	SAND–89-0567
DE90002629	SLAC–347
DE90002632	ORNL/TM–11120
DE90002633	SAND–89-0917
DE90002635	UCID–21682
DE90002636	UCID–21744
DE90002637	LA-UR–89-2000
DE90002638	SLAC–350
DE90002640	DOE/NASA–0352-3
DE90002643	SAND–89-7106
DE90002644	SAND–89-7039
DE90002648	DOE/PE–0092
DE90002651	SOL–89-14
DE90002653	ORNL/FTR–3449
DE90002654	ORNL/FTR–3437
DE90002656	LA-UR–89-3638
DE90002659	ORNL/FTR–3451
DE90002660	ORNL/FTR–3439
DE90002661	ORNL/FTR–3446
DE90002663	PNL-SA–16734
DE90002665	PNL-SA–17026
DE90002666	PNL-SA–17036
DE90002668	LBL–27421
DE90002669	LBL–27813
DE90002670	LBL–27606
DE90002673	PNL-SA–17359
DE90002675	PNL-SA–17004
DE90002676	PNL-SA–17111
DE90002678	LBL–27766
DE90002679	LBL–27746
DE90002680	LBL–27778
DE90002681	LBL–27765
DE90002682	LBL–27747
DE90002684	LBL–27429
DE90002688	DOE/ER–0184/5
DE90002690	DOE/MA–0384
DE90002692	DOE/ER/60634–1
DE90002694	DOE/ER/25068–1
DE90002695	CONF-8903169–2
DE90002697	DOE-tr–89-18
DE90002699	DOE-tr–89-0021
DE90002704	DOE/ER/60301–10
DE90002705	DOE/ER/13632–3
DE90002706	CONF-8910120–3
DE90002707	CONF-891079–1
DE90002710	CONF-891007–85
DE90002711	CONF-8910239–5
DE90002714	CONF-891007–83
DE90002717	CONF-8911113–1
DE90002720	DOE/OR/21400–T401
DE90002721	CONF-8905112–2
DE90002722	PNL-SA–17311
DE90002723	PNL-SA–16874-HEDR
DE90002725	PNL-SA–17250
DE90002726	PNL-SA–17367
DE90002727	PNL-SA–17385
DE90002728	PNL-SA–16809
DE90002732	PNL-SA–16875
DE90002733	PNL-SA–17267
DE90002734	PNL-SA–16968
DE90002737	PNL–6982
DE90002738	PNL–6984
DE90002739	DOE-tr–89-4
DE90002743	DOE-tr–89-5
DE90002744	DOE-tr–89-7
DE90002745	DOE-tr–89-34
DE90002746	ORNL/M–948
DE90002747	ORNL/FTR–3452
DE90002748	DOE-tr–89-40
DE90002749	DOE-tr–89-39
DE90002751	DOE-tr–89-46
DE90002754	UCRL–102044
DE90002755	DOE/ER/60294–T1
DE90002757	DOE/PC/88874–T6
DE90002759	DOE/PC/88941–T4
DE90002761	DOE/PC/88935–T3
DE90002764	DOE/PC/79926–6
DE90002765	DOE/PC/79926–7
DE90002766	DOE/PC/88922–4
DE90002767	DOE/ER/13295–3
DE90002769	DOE/ER/40266–2
DE90002770	DOE/ER/13277–T2
DE90002771	DOE/BP/23169–2
DE90002772	DOE/BP/12659–5
DE90002773	CONF-8910216–3
DE90002774	CONF-891046–4
DE90002775	CONF-8910239–4
DE90002776	CONF-8910282–1
DE90002777	CONF-8908175–1
DE90002778	CONF-8908133–7
DE90002779	DOE/BP/11287–12
DE90002781	DOE/BP/65903–2
DE90002782	DOE/BP/35245–2
DE90002783	DOE/BP/39643–3
DE90002784	UCRL–100794
DE90002785	UCRL–101879
DE90002786	UCRL–101088
DE90002787	UCRL–101148
DE90002789	UCRL–101145
DE90002790	UCRL–101113
DE90002791	DOE/PC/90519–T11
DE90002792	DOE/PC/30021–T20
DE90002793	DOE/PC/30021–T21
DE90002794	DOE/PC/30021–T22
DE90002795	UCRL–100432
DE90002797	SLAC-TN–89-1
DE90002798	SLAC-TN–89-2
DE90002799	ORNL/PPA–89/1
DE90002800	DOE/BP/35571–1
DE90002801	DOE/PC/88939–5
DE90002802	NIPER–438
DE90002803	SLAC/AP–76
DE90002804	SAND–89-1685
DE90002807	DOE/EIA–0380(89/08)
DE90002809	UCRL–100810
DE90002810	UCRL–100763
DE90002813	UCRL–99673-Rev.1
DE90002815	UCRL–21256
DE90002816	UCRL–100603
DE90002817	UCRL–101285
DE90002818	UCRL–100641
DE90002819	UCRL–101756
DE90002820	UCRL–98729
DE90002821	UCRL–100533
DE90002822	UCRL–100891
DE90002824	UCRL–21257
DE90002825	UCRL–21248
DE90002826	DOE/MC/25009–2752
DE90002827	UCRL–21249
DE90002828	UCRL–21250
DE90002829	ORNL/FTR–3434
DE90002830	LA–11702-MS
DE90002832	SAND–89-2533C
DE90002838	CONF-8907127–3
DE90002839	CONF-8908179–1
DE90002840	CONF-8908179–2
DE90002841	CONF-890821–6
DE90002842	CONF-890939–2
DE90002843	ANL-HEP-CP–89-112
DE90002844	CONF-8906242–1
DE90002845	CONF-8910287–1
DE90002848	CONF-891007–84
DE90002850	DOE/BP–1274
DE90002851	DOE/BP–1273
DE90002852	DOE/BP–1177
DE90002853	DOE/BP–1236
DE90002854	DOE/BP–1256
DE90002855	DOE/BP–1193
DE90002856	DOE/BP–1223
DE90002857	DOE/BP–1211
DE90002859	CONF-891093–11
DE90002860	CONF-891036–2
DE90002861	CONF-8910288–1
DE90002862	CONF-891001–9
DE90002863	CONF-891001–10
DE90002868	DOE/PC/90274–T6
DE90002869	DOE/PC/79796–T7
DE90002870	DOE/PC/79906–T2
DE90002872	DOE/EIA–0202(89/4Q)
DE90002873	DOE/ER/13695–T1
DE90002875	DOE/ER/40405–T2
DE90002880	DOE/ER/60015–7
DE90002882	DOE/ER/13855–2
DE90002884	SAND–88-2626C
DE90002886	UCRL–97265
DE90002888	UCRL–97266
DE90002893	PNL-SA–16690
DE90002894	PNL-SA–17443
DE90002909	LA–11685-T
DE90002910	DOE/HWP–94
DE90002914	GA-A–19756
DE90002915	GA-A–19860
DE90002916	FNAL/C–89/172

Order No.	Report No.
DE90002919	ORNL/RASA–87/36
DE90002921	ORNL/FTR–3457
DE90002923	PNL–7166
DE90002925	ANL–89/2-Rev.1
DE90002929	CONF-891119–4
DE90002931	CONF-8905112–3
DE90002934	CONF-891106–3
DE90002955	DOE/ER/53223–118
DE90002963	ORNL/FTR–3458
DE90002964	ORNL/FTR–3459
DE90002965	ORNL/FTR–3455
DE90002967	KCP–613-4127
DE90002969	LA–11474
DE90002970	DOE/ER/60555–3
DE90002971	SAND–86-2189C
DE90002973	UCRL–100936
DE90002974	UCRL–100596-Rev.1
DE90002975	UCRL–101915
DE90002976	UCRL–98308
DE90002982	UCRL–101105
DE90002995	UCRL–101481
DE90002996	ANL/PPRNT–89-188
DE90002998	ANL/PPRNT–89-186
DE90002999	ANL/PPRNT–89-185
DE90003001	ANL/PPRNT–89-184
DE90003002	ANL/PPRNT–89-183
DE90003003	ANL/PPRNT–89-192
DE90003004	ANL/PPRNT–89-191
DE90003005	ANL/PPRNT–89-190
DE90003006	ANL/PPRNT–89-189
DE90003007	ANL/PPRNT–89-195
DE90003008	ANL/PPRNT–89-194
DE90003009	ANL/PPRNT–89-193
DE90003010	ANL/PPRNT–89-199
DE90003011	ANL/PPRNT–89-198
DE90003012	ANL/PPRNT–89-197
DE90003013	ANL/PPRNT–89-196
DE90003014	UCRL–98191
DE90003023	UCRL–101649
DE90003024	UCRL–21254
DE90003025	UCRL–101247-Pts.1-2
DE90003028	MLM–3612(OP)
DE90003032	DOE/PC/90014–T3
DE90003033	DOE/PC/90014–T2
DE90003036	DOE/PC/88886–T4
DE90003039	DOE/PC/88934–T3
DE90003043	DOE/PC/88900–5
DE90003045	DOE/ER/60431–3
DE90003046	LBL–21520
DE90003047	DOE/ER/13711–1
DE90003053	UCRL–100847
DE90003058	UCRL–98780
DE90003060	CONF-8910193–4
DE90003065	CONF-891119–6
DE90003067	CONF-891103–44
DE90003070	DOE/EIA–0145(88)
DE90003076	CONF-891197–2
DE90003077	CONF-891007–88
DE90003079	LBL–26827
DE90003081	LBL–27225
DE90003082	LBL–27894
DE90003086	UCID–21775-Vol.1
DE90003087	UCID–21775-Vol.2
DE90003091	PNL–7130
DE90003092	DOE/MA/19117–T1
DE90003093	DOE/EIA–0226(89/08)
DE90003095	DOE/ER/13471–T2
DE90003097	CONF-8808145–
DE90003101	SOL–89-15
DE90003102	SOL–89-16
DE90003104	ORNL–6579
DE90003105	LBL–26796
DE90003106	LBL–26842
DE90003107	LBL–26248
DE90003108	LBL–26490
DE90003109	LBL–27874
DE90003112	LBL–27729
DE90003113	LBL–27834
DE90003114	LBL–25337
DE90003115	LBL–27940
DE90003116	LBL–27918
DE90003117	LBL–26600
DE90003118	LBL–24121
DE90003119	LBL–26612-Vol.1
DE90003120	LBL–27937
DE90003121	LBL–25790
DE90003122	LBL–27938
DE90003124	LBL–27916
DE90003126	LBL–27534
DE90003127	LBL–27885
DE90003153	SAND–89-1665C
DE90003162	SAND–89-1711C
DE90003170	LA-UR–89-3699
DE90003171	LA-UR–89-3695
DE90003182	DOE/ER/40416–2
DE90003183	FNAL-TM–1626
DE90003184	FNAL-TM–1623
DE90003253	BNL–43464
DE90003254	BNL–42814
DE90003255	BNL–43373
DE90003259	DOE/CE/34002–1
DE90003260	BNL–43394
DE90003261	BNL–42550-Rev.
DE90003262	BNL–43128
DE90003265	LBL–27806
DE90003267	LBL–26828
DE90003270	LBL–26843
DE90003271	LBL–26844
DE90003272	LBL–27881
DE90003273	LBL–27846
DE90003274	LBL–27878
DE90003275	LBL–27919
DE90003277	DOE/CE–0256-1
DE90003278	ORNL/RASA–89/7
DE90003279	ORNL/RASA–89/5
DE90003281	ORNL/RASA–89/8
DE90003282	ORNL/RASA–89/9
DE90003286	ORNL/FTR–3473
DE90003287	GA-A–19752
DE90003288	GA-A–19751
DE90003289	GA-A–19748
DE90003290	GA-A–19747
DE90003291	GA-A–19741
DE90003292	GA-A–19739
DE90003294	LBL–26704
DE90003295	PPPL–2660
DE90003296	LBL–27230
DE90003297	LBL–25674-Rev.
DE90003298	LBL–27450
DE90003299	LBL–26703
DE90003300	LBL–27001
DE90003310	DOE/PC/89904–T4
DE90003314	DOE/ER/60655–2
DE90003318	DOE/ET/53088–401
DE90003319	DOE/ET/53088–407
DE90003320	DOE/ER/40224–114
DE90003322	DOE/PC/90521–T12
DE90003323	DOE/ER/40224–115
DE90003324	DOE/ER/40224–87
DE90003325	DOE/ER/40224–86
DE90003326	DOE/ER/40224–85
DE90003327	DOE/ER/40224–90
DE90003328	DOE/ER/40224–91
DE90003331	DOE/ER/40224–129
DE90003332	DOE/ER/40224–110
DE90003335	DOE/ER/40427–12-N9
DE90003336	DOE/ER/40427–11-N9
DE90003337	DOE/ER/40427–09-N9
DE90003343	GA-A–19742
DE90003345	FNAL/C–89/232-T
DE90003348	DOE/ER/40427–20-N9
DE90003349	DOE/ER/40427–14-N9
DE90003350	DOE/ER/40427–13-N9
DE90003351	DOE/ER/60313–4
DE90003353	DOE/ER/40224–108
DE90003355	DOE/ER/13777–2
DE90003361	WHC-SA–0616
DE90003364	GA-A–19740
DE90003367	LA-UR–89-4011
DE90003368	DOE/ER/40193–T3
DE90003370	DOE/PC/88947–T4
DE90003371	DOE/PC/88917–T2
DE90003372	DOE/PC/88813–T4
DE90003373	DOE/PC/88812–T5
DE90003374	DOE/PC/88881–T4
DE90003375	DOE/ER/60561–T1
DE90003376	DOE/ER/53223–T2
DE90003384	ANL-HEP-CP–89-122
DE90003659	DOE/ER/13472–3
DE90606947	IC–89/110
DE90606948	IC–89/111
DE90606949	IC–89/126
DE90606950	IC–89/130
DE90606951	IC–89/140
DE90606952	IC–89/157
DE90606953	IC–89/171
DE90606954	IC–89/177
DE90606955	IC–89/183
DE90606956	IC–89/192
DE90606957	IC–89/195
DE90606958	IC–89/206
DE90606959	IC–89/215
DE90606960	IC–89/216
DE90606961	IC–89/217
DE90607043	IC–89/158
DE90607044	IC–89/162
DE90607045	IC–89/167
DE90607046	IC–89/80
DE90607062	IC–89/185
DE90607090	CTA-IEAv-RP–018/85
DE90607091	IC–89/115
DE90607092	IC–89/145
DE90607093	IC–89/160
DE90607094	IC–89/168
DE90607095	IC–89/173
DE90607096	IC–89/179
DE90607097	IC–89/258
DE90607098	INFN-LNF–89/042(PT)
DE90607100	RAL–89-048
DE90607101	RAL–89-052
DE90607151	IC–89/211
DE90607231	IC–89/101
DE90607232	IC–89/102
DE90607233	IC–89/156
DE90607234	IC–89/197
DE90607235	IC–89/239
DE90607259	IC–89/121
DE90607260	IC–89/132
DE90607261	IC–89/159
DE90607262	INIS-BR–1698
DE90607263	INIS-BR–1702
DE90607264	INIS-BR–1717
DE90607267	INIS-BR–1755
DE90607268	INIS-BR–1762
DE90607269	INIS-BR–1767
DE90607270	INIS-BR–1769

Order No.	Report No.
DE90607372	INIS-mf-4754(no.39)
DE90607452	IC-89/122
DE90607469	IC-89/131
DE90607470	IC-89/152
DE90607471	IC-89/172
DE90607489	INDC(CCP)-301/GF
DE90607581	INIS-BR-1706
DE90607607	IC-89/141
DE90607608	IC-89/178
DE90607609	JYFL-RR-1/1989
DE90607635	IC-89/196
DE90607636	IC-89/74
DE90607643	RAL-89-026
DE90607644	IC-89/137
DE90607655	INDC(NDS)-224/GF
DE90607662	INIS-BR-1683
DE90607666	IC-89/133
DE90607667	IC-89/202
DE90607715	IC-89/182
DE90607716	IC-89/187
DE90607755	IC-89/209
DE90607759	INDC(NDS)-220
DE90607770	BARC-1464
DE90607783	INIS-BR-1764
DE90607797	JYFL-RR-3/1988
DE90607803	INDC(CCP)-302/L
DE90607848	INIS-BR-1627
DE90607849	INIS-BR-1700
DE90607850	INIS-BR-1722
DE90607851	INIS-BR-1727
DE90607852	INIS-BR-1754
DE90607853	INIS-BR-1760
DE90607854	INIS-BR-1768
DE90607877	INIS-BR-1701
DE90607878	INIS-BR-1726
DE90607879	INIS-BR-1730
DE90607880	INIS-BR-1731
DE90607881	INIS-BR-1732
DE90607886	IEN-DQUI-DIQUI-NT-01/80
DE90607887	INIS-BR-1699
DE90607888	INIS-BR-1723
DE90607889	INIS-BR-1724
DE90607890	INIS-BR-1725
DE90607891	INIS-BR-1728
DE90607892	INIS-BR-1729
DE90607893	INIS-BR-1770
DE90607900	AEEW-R-2227
DE90607901	AEEW-R-2305
DE90607902	AEEW-R-2341
DE90607903	PPA-T-85
DE90607940	INIS-BR-1736
DE90607954	BARC-1447
DE90607956	INIS-BR-1672
DE90607957	INIS-BR-1710
DE90607959	CEGB-TPRD/M-1697/RR88
DE90607963	BARC-1449
DE90607968	CEGB-RD/L-3354/R88
DE90607970	INIS-BR-1689
DE90607971	PPA-T-84
DE90607993	CEGB-RD/B-6040/R88
DE90607994	INIS-BR-1765
DE90608000	JYFL-RR-2/1987
DE90608043	IC-89/147
DE90608085	PPA-T-82
DE90608086	PPA-T-86
DE90608107	INIS-BR-1766
DE90608113	INIS-mf-11557
DE90608131	INIS-BR-1703
DE90608161	IC-89/50
DE90608162	IC-89/51
DE90608173	IC-89/63
DE90608185	JET-R-89-06
DE90608198	INIS-BR-1740
DE90608255	INIS-BR-1735
DE90608276	INIS-mf-11543(No.1)
DE90608312	CNEN-DR-112/82
DE90608313	INIS-BR-1741
DE90608314	INIS-BR-1759
DE90608315	INIS-BR-1733
DE90608322	INIS-BR-1744
DE90608330	PPA-T-7
DE90608331	SAAS-372
DE90608332	AEEW-R-1903
DE90608333	INIS-BR-1718
DE90608334	INIS-BR-1720
DE90608335	SAAS-373
DE90608336	SAAS-374
DE90608337	SAAS-375
DE90608340	BARC-1453
DE90608341	INIS-BR-1688
DE90608344	INIS-BR-1719
DE90608345	INIS-BR-1747
DE90608346	INIS-mf-11558
DE90608347	INIS-mf-11562
DE90608415	IAEA-R-3948-F
DE90608416	INIS-BR-1734
DE90608417	INIS-BR-1737
DE90608418	INIS-BR-1738
DE90608593	PPA-T-89
DE90608596	PPA-T-83
DE90608597	PPA-T-88
DE90608605	AEEW-R-2201
DE90608607	INIS-BR-1686
DE90608608	INIS-BR-1691
DE90608611	LNCC-009/89
DE90608612	LNCC-010/89
DE90608613	LNCC-011/89
DE90608621	INIS-BR-1721
DE90608623	AEEW-M-2496
DE90608625	AEEW-M-2520
DE90608626	AEEW-R-2033
DE90608630	IC-89/170
DE90608638	JYFL-RR-1/1987
DE90608656	INIS-BR-1695
DE90608683	IAEA-TECDOC-507
DE90608689	YJT-89-08
DE90608697	CNEN-DR-88/80/A
DE90608701	INIS-BR-1713
DE90608702	INIS-BR-1714
DE90608703	INIS-BR-1715
DE90608737	STUK-A-86
DE90608738	STUK-B-YTO-54
DE90608739	STUK-B-YTO-56
DE90608788	INIS-BR-1748
DE90608789	INIS-BR-1749
DE90608804	INIS-BR-1685
DE90608812	INIS-BR-1750
DE90608837	AEEW-M-2536
DE90608838	AEEW-R-2094
DE90608868	INIS-BR-1743
DE90608880	IAEA-INFCIRC-369
DE90608889	IAEA-INFCIRC-2(Rev.37)
DE90608891	INIS-BR-1745
DE90608892	IPEN-PUB-219
DE90608893	UJV-8715-V
DE90705937	INIS-SU-114
DE90705938	NEI-DK-179
DE90705939	IAERU-8802
DE90705940	IPPJ-REV-4
DE90705941	RCNP-P-105
DE90717862	ETDE-mf-0717862
DE90717865	ETDE-mf-0717865
DE90717888	ETDE-mf-0717888
DE90717889	ETDE-mf-0717889
DE90717911	ETDE-mf-0717911
DE90717914	GSF-26/88
DE90717917	ETDE-mf-0717917
DE90717921	ETDE-mf-0717921
DE90717924	ETDE-mf-0717924
DE90718061	ETDE-mf-0718061
DE90718064	IBP-WB-11/87
DE90718075	ETDE-mf-0718075
DE90718079	ETDE-mf-0718079
DE90718080	ETDE-mf-0718080
DE90718167	ETDE-mf-0718167
DE90718175	KFK-PEF-52
DE90718193	ETDE-mf-0718193
DE90718198	IKE-7-9
DE90718199	ETDE-mf-0718199
DE90718756	INIS-mf-12007
DE90718808	EEO-ED-241/224
DE90718922	RISO-R-568
DE90718926	RISO-M-2800
DE90718930	RISO-M-2798
DE90718933	RISO-M-2803
DE90718936	RISO-M-2795
DE90718968	NEI-DK-210
DE90718971	DTH-LV-88-18
DE90718974	NEI-DK-211
DE90718977	NEI-DK-212
DE90718982	NEI-DK-213
DE90718986	NEI-DK-214
DE90718990	DTH-LV-MEDD-197
DE90718997	NEI-DK-215
DE90719030	NEI-DK-216
DE90719033	NEI-DK-217
DE90719047	NEI-DK-218
DE90719068	NEI-DK-219
DE90719157	NEI-DK-220
DE90719162	NEI-DK-221
DE90719250	NEI-DK-222
DE90719259	NEI-DK-224
DE90719264	NEI-DK-225
DE90719270	DTH-LV-87-11
DE90719284	SL-1251-85195-20
DE90719291	RISO-M-2801
DE90719294	NEI-DK-227
DE90719297	NEI-DK-228
DE90719301	NEI-DK-229
DE90719311	NEI-DK-230
DE90719324	KTM/E-D-173
DE90719327	KTM/E-D-174
DE90719328	KTM/E-D-172
DE90719329	OPTIMITURVE-3
DE90719330	OPTIMITURVE-2
DE90719331	OPTIMITURVE-5
DE90719332	OPTIMITURVE-6
DE90719334	VTT-TUTK-622
DE90719335	VTT-TUTK-990
DE90719337	VTT-TIED-985
DE90719338	VTT-TIED-986
DE90719339	VTT-TIED-987
DE90719340	VTT-TIED-988
DE90719341	VTT-TIED-989
DE90719342	VTT-TIED-944
DE90719343	OY/PSTL-TIED-63
DE90719344	VTT-TUTK-621
DE90719345	NEI-FI-14
DE90719346	VTT-TIED-982
DE90719347	VTT-TIED-1028
DE90719348	VTT-TIED-829
DE90719389	NILU/OR-78/88
DE90719391	STF-15A88028
DE90719392	STEV-1989-R5
DE90719393	SLU-ISK-179
DE90719394	STU-I-707-1988

Order No.	Report No.
DE90719395	NEI-SE–43
DE90719396	NEI-SE–44
DE90719408	SVF–336
DE90719409	SVF–339
DE90719410	SVF–340
DE90719411	SVF–341
DE90719412	SV–2000-352-2
DE90719413	LiU-Tek-Lic–1989-13
DE90719414	LiU-Tek-Lic–1989-04
DE90719415	STU–86-4162
DE90719416	CTH-JVG–27
DE90719417	SNV–3593
DE90719421	IVL-B–912
DE90719422	BFR-R–49-1989
DE90719434	STEV-FBT–89-24
DE90719435	STEV-FBT–89-25
DE90719436	STEV-FBT–89-26
DE90719437	STEV-FBT–89-27
DE90719438	STEV-VIND–89-17
DE90719473	JAERI-M–89-060
DE90719505	INS–744
DE90719506	INS–745
DE90719507	INS–746
DE90719508	INS–748
DE90719509	INS–749
DE90719510	JAERI-M–89-064
DE90719511	JAERI-M–89-063
DE90719518	PPLK-R–34
DE90719519	PPLK-R–33
DE90719520	PPLK-R–31
DE90719521	PPLK-R–29
DE90719522	PPLK-R–28
DE90719523	PPLK-R–27
DE90719524	PPLK-R–26
DE90719525	PPLK-R–30
DE90719526	JAERI-M–89-075
DE90719527	JAERI-M–89-088
DE90719528	JAERI-M–89-086
DE90719529	JAERI-M–89-018
DE90719530	JAERI-M–89-069
DE90719531	JAERI-M–89-066
DE90719532	PPLK-R–35
DE90719536	JAERI-M–89-074
DE90719537	JAERI-M–89-071
DE90719538	JAERI-M–89-079
DE90719539	JAERI-M–89-080
DE90719540	JAERI-M–89-077
DE90719541	JAERI-M–89-070
DE90719542	JAERI-M–89-078
DE90719543	IPPJ-DT–152
DE90719544	JAERI-M–89-061
DE90719545	JAERI-M–89-084
DE90719546	JAERI-M–89-085
DE90719547	JAERI-M–89-076
DE90719548	JAERI-M–89-081
DE90719553	PNCT-N–8410-89-010
DE90719554	PNCT-N–8410-89-009
DE90719555	PNCT-N–8410-89-008
DE90719556	RRK–89-16
DE90719557	INS–751
DE90719558	INS–750
DE90719559	INS–752
DE90719560	JAERI-M–89-082
DE90719572	JAERI-M–89-090
DE90719573	JAERI-M–89-093
DE90719574	JAERI-M–89-094
DE90719575	INS–754
DE90719576	INS–755
DE90719577	INS–757
DE90719578	INS–756
DE90719604	JAERI–1318
DE90719605	JAERI-M–89-096
DE90719606	JAERI-M–89-091
DE90719607	JAERI-M–89-087
DE90719693	NIRS-M–70
DE90719705	IPPJ-T–38
DE90719706	KURRI-TR–315
DE90719707	RCNP-P–102
DE90719709	NIRS-R–15
DE90719711	INS–747
DE90719713	PPLK–10
DE90719714	IPPJ-DT–147
DE90719715	IPPJ-DT–146
DE90721092	CRN-PN–85-31
DE90721101	CEA-DAS–603
DE90721102	FRNC-TH–3474
DE90721127	NEACRP–302-L(Rev.)
DE90721137	CEA-N–2605
DE90721138	CEA-N—2606
DE90721139	CEA-N–2607
DE90721179	CEA-CONF–9877
DE90721224	CEA-R–5492
DE90721226	CEA-R–5475
DE90721233	CEA-DAS–539
DE90721234	FRCEA-TH–189
DE90721235	CEA-CONF–9799
DE90721236	CEA-CONF–9796
DE90721238	NEANDC-E–292-U-Vol.III-Euratom
DE90721239	CEA-CONF–9800
DE90721240	CENBG–88-25
DE90721241	CENBG–89-04
DE90721242	IPNO-TH–88-61
DE90721243	PCCF-T–88-18
DE90721244	PCCF-T–88-16
DE90721245	CRN-RA–1987
DE90721817	CONF-8811286–Absts.
DE90721837	ETDE-mf–0721837
DE90721861	ETDE-mf–0721861
DE90721863	ETDE-mf–0721863
DE90721871	Juel–2250
DE90721890	NIR–1/88
DE90721901	Juel-Spez–493
DE90721936	ETDE-mf–0721936
DE90721937	ETDE-mf–0721937
DE90721938	Juel–2212
DE90721946	ETDE-mf–0721946
DE90721986	INIS-mf–12018
DE90722011	NUKEM-FuE–88041
DE90722065	INIS-mf–12011
DE90722072	KFK–4527
DE90722092	SIEMENS-KWU-U9–414/88/022
DE90722093	ETDE-mf–0722093
DE90722124	INIS-mf–12013
DE90722226	Juel-Spez–488
DE90722241	INIS-mf–12020
DE90722246	INIS-mf–12015
DE90722258	ETDE-mf–0722258
DE90722260	INIS-mf–12016
DE90722261	INIS-mf–12017
DE90722264	ETDE-mf–0722264
DE90722280	KFK–4447
DE90722300	ETDE-mf–0722300
DE90722301	ETDE-mf–0722301
DE90722329	ECN–220
DE90722330	ECN–222
DE90722342	ETDE-mf–0722342
DE90722344	ETDE-mf–0722344
DE90722428	ECN-PB–89-4
DE90722431	INIS-mf–12019
DE90722448	KFK–4622
DE90722455	TNO-HMT-R–88/253C
DE90722472	TNO-HMT–88-342
DE90722473	TNO-HMT–88-342/Suppl
DE90722496	INIS-mf–12012
DE90722671	BRE-IP–10/89
DE90722672	BRE-IP–11/89
DE90722715	ETSU-R–48
DE90722716	GB–206
DE90722758	ETSU-WN–5063
DE90722759	ETSU-WN–5098
DE90722760	ETSU-SSH–4063-P1
DE90722761	ETSU-GEN–2006-P2
TI89004067	NUREG/CR–5225
TI89009127	NUREG/CR–5293
TI90001480	NUREG/CR–5215
TI90001527	NUREG/CP–0102-Vol.1
TI90001684	NUREG–0540-Vol.2-No.7
TI90001686	NUREG/CR–5395-Vol.6
TI90001687	NUREG/CR–5395-Vol.4
TI90001688	NUREG/CR–5395-Vol.7
TI90001689	NUREG/CR–5395-Vol.8
TI90001753	NUREG/CR–5430-Vol.2
TI90001756	NUREG/CR–5364
TI90001806	DOE/IG–0273
TI90001904	NUREG/CR–5294
TI90001927	NUREG/CR–5430-Vol.1
TI90002097	NUREG/CP–0103
TI90002126	NUREG/IA–0028
TI90002127	NUREG/IA–0029
TI90002158	NUREG/CR–5429-Vol.2
TI90002159	NUREG–0383-Vol.3-Rev.9
TI90002160	NUREG–0383-Vol.1-Rev.12
TI90002161	NUREG–0383-Vol.2-Rev.12
TI90002162	NUREG/CR–5430-Vol.3
TI90002279	NUREG–1384-Vol.1
TI90002284	NUREG/CR–5269
TI90002312	NUREG–0936-Vol.8-No.3
TI90002338	NUREG–1232-Vol.3-Suppl.1
TI90002504	NUREG/CR–2850-Vol.8
TI90002526	NUREG–0540-Vol.2-No.8
TI90002535	BR–82(11.111)
TI90002587	NUREG/CR–5236
TI90002652	OCS/MMS–89-0058
TI90002677	NUREG/CR–5418
TI90002689	DOE/RW–0245
TI90002736	NUREG/CR–2907-Vol.8
TI90002814	BR–85(7.27)
TI90002837	NUREG–1351
TI90002895	NUREG–0775-Suppl.
TI90002954	NUREG–1378
TI90002968	BR–82(11.113)
TI90003094	CEC–90003094
TI90003103	SAIC–90003103
TI90003156	NUREG/CR–5466
TI90003338	NUREG/CR–5441

Codes Used on Index Lines

Following the citation numbers in the Corporate Author, Personal Author, and Subject Indexes, codes are used to designate the type of document, country of publication, and language of the document, e.g., (R;SU;In Russian). The language designator does not appear if the document is published in English.

Document Types

J	Journal article
TJ	Translation of a journal article
R	Report
RA	Report analytic
B	Book
BA	Book analytic
P	Patent
E	Engineering materials
D	Dissertation
TG	Translation (general)
TA	Translation (analytic)

Country Codes

AD	Andorra
AE	United Arab Emirates
AF	Afghanistan
AL	Albania
AR	Argentina
AT	Austria
AU	Australia
BB	Barbados
BD	Bangladesh
BE	Belgium
BG	Bulgaria
BH	Bahrain
BI	Burundi
BJ	Benin
BM	Bermuda
BO	Bolivia
BR	Brazil
BS	Bahamas
BT	Bhutan
BU	Burma
BW	Botswana
BY	Byelorussian Soviet Socialist Republic (Byelorussian SSR)
CA	Canada
CB	Khmer Republic
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Ivory Coast
CL	Chile
CM	United Republic of Cameroon
CN	China
CO	Colombia
CR	Costa Rica
CS	Czechoslovakia
CU	Cuba
CY	Cyprus
DD	German Democratic Republic
DE	Germany, Fed. Republic of (F.R. Germany)
DK	Denmark
DO	Dominican Republic
DZ	Algeria
EC	Ecuador
EG	Egypt
ES	Spain
ET	Ethiopia
FI	Finland
FJ	Fiji
FR	France
GA	Gabon
GB	United Kingdom of Great Britain and Northern Ireland (UK)
GD	Grenada
GH	Ghana
GM	Gambia
GN	Guinea
GQ	Equatorial Guinea
GR	Greece
GT	Guatemala
GU	Guam
GW	Guinea-Bissau
GY	Guyana
HK	Hong Kong
HN	Honduras
HT	Haiti
HU	Hungary
HV	Upper Volta
ID	Indonesia
IE	Ireland
IL	Israel
IN	India
IQ	Iraq
IR	Iran
IS	Iceland
IT	Italy
JM	Jamaica
JO	Jordan
JP	Japan
KE	Kenya
KH	Democratic Kampuchea
KP	Democratic People's Republic of Korea
KR	Korea, Republic of
KW	Kuwait
LA	Laos
LB	Lebanon
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LU	Luxembourg
LY	Libyan Arab Republic
MA	Morocco
MC	Monaco
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MT	Malta
MU	Mauritius
MV	Maldives
MW	Malawi
MX	Mexico
MY	Malaysia
NE	Niger
NG	Nigeria
NI	Nicaragua
NL	Netherlands
NO	Norway
NP	Nepal
NR	Nauru
NZ	New Zealand
OM	Oman
PA	Panama
PE	Peru
PG	Papua New Guinea
PH	Philippines
PK	Pakistan
PL	Poland
PR	Puerto Rico
PT	Portugal
PY	Paraguay
QA	Qatar
RH	Southern Rhodesia
RO	Romania
RW	Rwanda
SA	Saudi Arabia
SD	Sudan
SE	Sweden
SG	Singapore
SK	Sikkim
SL	Sierra Leone
SM	San Marino
SN	Senegal
SO	Somalia
SU	Union of Soviet Socialist Republics (USSR)
SV	El Salvador
SY	Syria
SZ	Swaziland
TD	Chad
TG	Togo
TH	Thailand
TN	Tunisia
TO	Tonga
TR	Turkey
TT	Trinidad and Tobago
TW	Taiwan
TZ	United Republic of Tanzania
UA	Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG	Uganda
US	United States of America (USA)
UY	Uruguay
VA	Holy See
VE	Venezuela
VI	Virgin Islands of the United States
VN	Viet Nam
WS	Western Samoa
YD	Democratic Yemen
YE	Yemen
YU	Yugoslavia
ZA	South Africa
ZM	Zambia
ZR	Zaire
ZW	Zimbabwe

☆U. S. GOVERNMENT PRINTING OFFICE: 1989/748-113/00019

ORDER FORM

DOE and DOE contractors: Fill in Parts I, II, and IV. **Others:** Fill in Parts I, III, and IV. Mark appropriate blanks in Part IV to indicate quantity and form (microfiche or paper copy).

I. SHIPPING AND PAYMENT INFORMATION

Ordering Address

Name _____ Telephone _____

Address _____

City _____ State _____ ZIP _____

Shipping Address (if different from above)

Name _____

Address _____

City _____ State _____ ZIP _____

_____

SIGNATURE (Required to validate ALL orders)

II. OSTI ORDERS (DOE and DOE contractors can order from OSTI.)

☐ Charge OSTI deposit account no. _____

Mail orders to: U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

III. NTIS ORDERS

☐ Charge NTIS deposit account no. _____

☐ Check/Money Order enclosed for $ _____

☐ Charge to my ☐ American Express ☐ VISA ☐ MasterCard

_____ _____
Account Number Card expiration date

☐ Ship & Bill (see below for restrictions)

Employer identification number (9 digits) __ __ - _ _ _ _ _ _ _

Purchase Order number _____

Phone number of billing office _____
(Required for Ship & Bill orders)

Ship & Bill service is restricted to North American business locations for an extra $7.50 per order (or per Custom Search). The business' employer identification number plus the phone number of the office paying the bill are required to process these requests. A late payment charge will be applied to billings more than 30 days overdue. Prepaying, using an NTIS Deposit Account or a charge account, speeds order processing. Be sure payment and order are sent together. Checks, payable to NTIS, must be in U.S. dollars.

Mail orders to: U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

IF NO METHOD OF PAYMENT IS INDICATED, YOUR ORDER WILL BE RETURNED TO YOU AS A PRICE QUOTE UNPROCESSED.

IV. SELECTIONS

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

CUT OUT APPROPRIATE FORM AND MAIL IN A STAMPED ENVELOPE TO THE ADDRESS INDICATED.

Change of Address Form

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

Attach last subscription label here.

MAIL THIS FORM TO:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Subscription Order Form

Enter my Subscription to: _____

(Please indicate publication)

@ $_____ Domestic; @ $_____ Foreign.

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No._____

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

Federal Depository Library Program

As a result of an agreement between the U.S. Government Printing Office (GPO) and the Department of Energy, beginning in 1984 DOE reports with unlimited distribution are now included in the Federal Depository Library Program. The Regional Depository Libraries listed below receive and retain at least one copy of nearly every Federal Government publication, either in printed or microfilm form, for use by the general public. These libraries provide reference services and interlibrary loans; however, they are not sales outlets. You may wish to ask your local library to contact a Regional Depository to help you locate specific publications, or you may contact the Regional Depository yourself. Do not send checks or orders to these libraries.

ARKANSAS STATE LIBRARY
One Capitol Mall
Little Rock, AR 72201
(501) 371-2326

AUBURN UNIV. AT MONTGOMERY LIBRARY
Documents Department
Montgomery, AL 36193
(205) 279-9110, ext. 253

UNIV. OF ALABAMA LIBRARY
Documents Dept.-Box S
University, AL 35486
(205) 348-7369

DEPT. OF LIBRARY, ARCHIVES AND PUBLIC RECORDS
Third Floor-State Cap.
1700 West Washington
Phoenix, AZ 85007
(602) 255-4121

UNIVERSITY OF ARIZONA LIB.
Government Documents Dept.
Tucson, AZ 85721
(602) 626-5233

CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 2037
Sacramento, CA 95809
(916) 322-4572

UNIV. OF COLORADO LIB.
Government Pub. Division
Campus Box 184
Boulder, CO 80309
(303) 492-8834

DENVER PUBLIC LIBRARY
Govt. Pub. Department
1357 Broadway
Denver, CO 80203
(303) 571-2131

CONNECTICUT STATE LIBRARY
Government Documents Unit
231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971

UNIV. OF FLORIDA LIBRARIES
Library West
Documents Department
Gainesville, FL 32611
(904) 392-0367

UNIV. OF GEORGIA LIBRARIES
Government Reference Dept.
Athens, GA 30602
(404) 542-8951

UNIV. OF HAWAII LIBRARY
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230

UNIV. OF IDAHO LIBRARY
Documents Section
Moscow, ID 83843
(208) 885-6344

ILLINOIS STATE LIBRARY
Information Services Branch
Centennial Building
Springfield, IL 62706
(217) 782-5185

INDIANA STATE LIBRARY
Serials Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3686

UNIV. OF IOWA LIBRARIES
Govt. Documents Department
Iowa City, IA 52242
(319) 353-3318

UNIVERSITY OF KANSAS
Doc. Collect.-Spencer Lib.
Lawrence, KS 66045
(913) 864-4662

UNIV. OF KENTUCKY LIBRARIES
Govt. Pub. Department
Lexington, KY 40506
(606) 257-3139

LOUISIANA STATE UNIVERSITY
Middleton Library
Govt. Docs. Dept.
Baton Rouge, LA 70803
(504) 388-2570

LOUISIANA TECHNICAL UNIV. LIBRARY
Documents Department
Ruston, LA 71272
(318) 257-4962

UNIVERSITY OF MAINE
Raymond H. Fogler Library
Tri-State Regional Documents Depository
Orono, ME 04469
(207) 581-1680

UNIVERSITY OF MARYLAND
McKeldin Lib.-Doc. Div.
College Park, MD 20742
(301) 454-3034

BOSTON PUBLIC LIBRARY
Government Docs. Dept.
Boston, MA 02117
(617) 536-5400 ext. 226

DETROIT PUBLIC LIBRARY
Sociology Department
5201 Woodward Avenue
Detroit, MI 48202
(313) 833-1409

MICHIGAN STATE LIBRARY
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640

UNIVERSITY OF MINNESOTA
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7813

UNIV. OF MISSISSIPPI LIB.
Documents Department
University, MS 38677
(601) 232-5857

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA LIBRARY COMM.
Federal Documents
1420 P Street
Lincoln, NE 68508
(402) 471-2045
(in cooperation with University of Nebraska-Lincoln)

UNIVERSITY OF NEVADA LIB.
Govt. Pub. Department
Reno, NV 89557
(702) 784-6579

NEWARK PUBLIC LIBRARY
5 Washington Street
Newark, NJ 07101
(201) 733-7812

UNIVERSITY OF NEW MEXICO
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-2033, ext. 22

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Wilson Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1321

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
(in cooperation with North Dakota State Univ. Library)

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA DEPT. OF LIBRARIES
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927-Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH. UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

UNIVERSITY OF VIRGINIA
Alderman Lib.-Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506
(304) 293-3640

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3000

ST. HIST. LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
(307) 777-6344

Order Number Correlation	Report Number Index	Contract Number Index	Subject Index	Personal Author Index	Corporate Author Index